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How Long Between Grinds?

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Secretary, A.S.M.E. Subcommittee on Metal-Cutting Data

Some calculations to prove that there is one particular tool life under cut that results in minimum cost per piece of the work turned out, and that it varies with the job and with local conditions

"USE PQR tool steel and increase the life of the tool between grinds," is so common a statement as to arouse only the feeblest interest in the steel user. He has heard it too many times before. And he has also heard and probably believes that the average tool life for ordinary shop work should be about so much.

What he probably has not heard is that the determination of the most economical tool, together with the best life to be used for it, demands the solving of a problem in economics involving the tool cost per grind, the labor rate paid to tool dressers, tool grinders and machine operators, the time required for dressing, grinding and changing tools, and the indirect or overhead cost proper for the shop in question. No satisfactory decision can be made as to the best tool material until an accurate comparison of costs involving all the factors has been made. And it is apparently not realized that there is one specific tool life under cut which gives the lowest overall cost for a given set of conditions.

Three Typical Jobs

To illustrate this point, and to show the nature of the calculations involved, the most economical tool life will be figured for three typical jobs, involving three different tooling conditions. These jobs do not represent actual parts, but were drawn to represent three classes of work which are believed to constitute a large part of the turning done in the average machine shop in the country. No figures are given on automatics, as no detailed machining data was available, but the method to be used is substantially the same.

The first job, which is shown in Fig. 1, represents a single part similar to a locomotive crankpin, which is completely finished on a heavy engine lathe. Forged tools ¾ x 1⅛ in., made of standard 18-4-1 tool steel, are used and it is assumed that all tools are ground in a central tool grinding room. While the exact times assumed for handling and machining of the part, and for changing, dressing and grinding the tool, are not important for the demonstration, the best available times were used. The handling time is such that it should be somewhat generous for a shop operating under scientific management with wage incentives for direct labor. The machining times were calculated from some unpublished data which is believed to represent the best possible cutting practice with standard 18-4-1 high speed steel, hardened and tempered to develop maximum cutting capacities. Tool changing, tool dressing and tool grinding times were taken from "The Art of Cutting Metals" by F. W. Taylor. Incidentally, Taylor recognized the fact that there was one best tool life for use under a given set of cutting conditions, and indicated the necessary calculations for determining it. It is strange that this part of his work has apparently been overlooked.

In Table I the individual costs are worked out for a number of arbitrarily assumed tool lives, ranging from 5 min. to 360 min. It is realized that 5 min. is a shorter time than any shop could consider practical, but it was thought desirable to include calculations covering a wide range, so that there might be no doubt about the curve which was plotted for the final cost figures.

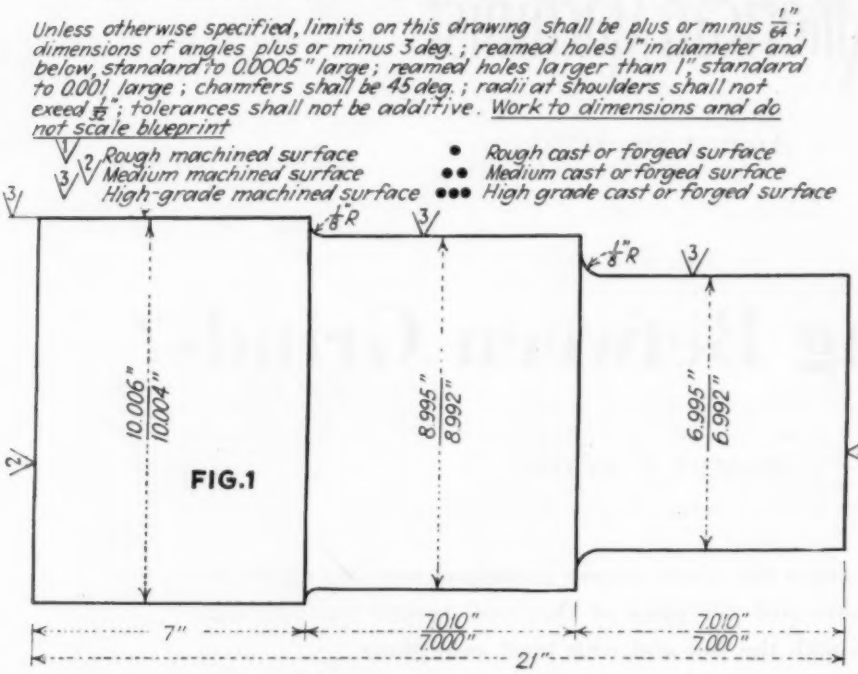
The machining time was first calculated on the basis of a 60-min. tool life, for which data were available, and then recalculated for each of the other assumed tool lives, using the well known formula $V \times T^{\frac{1}{8}} = \text{a constant}$; where V = speed of tool in feet per minute, T = length of time tool must last without grinding. (Taylor, "On the Art of Cutting Metals," page 159).

The number of grinds necessary per piece was determined by dividing the machining time per piece by the tool life between grinds.

Tool Changing Time

The time required for changing dull tools was obtained by multiplying the number of grinds necessary per piece—which is also theoretically the number of extra tool changes necessary—by 1.7 min., the time required to change one tool. It is probable, under ordinary shop conditions, that the operator would not make this number of changes, but would replace tools at some time when a tool change was necessary because of the end of a cut. Such a practice however, would increase both the consumption of tool steel, and the time required to grind tools, so that it is believed that this increase would substantially balance any saving in tool changing time, and that the method as

Fig. 1—Typical heavy turning job, SAE 1035 hot rolled steel. Fig. 2—Cost chart for job shown in Fig. 1


Unless otherwise specified, limits on this drawing shall be plus or minus 1/64"; dimensions of angles plus or minus 3 deg.; reamed holes 1" in diameter and below, standard to 0.0005" large; reamed holes larger than 1" standard to 0.001 large; chamfers shall be 45 deg.; radii at shoulders shall not exceed 1/32"; tolerances shall not be additive. Work to dimensions and do not scale blueprint
Rough machined surface
Medium machined surface
High-grade machined surface
Rough cast or forged surface
Medium cast or forged surface
High grade cast or forged surface
1/8" R
10.006" 10.004"
8.995" 8.992"
6.995" 6.992"
7.010" 7.000"
7"
21"
FIG.1

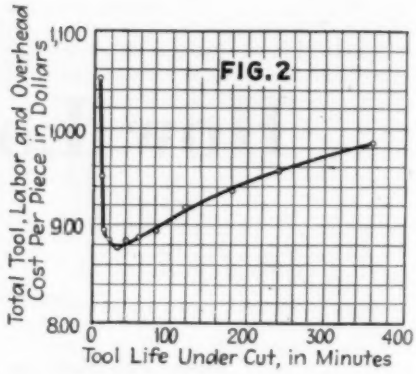


Table I—Costs for arbitrarily assumed tool life, varying from 5 to 360 min., on job shown in Fig. 1

Tool Life Under Cut In Minutes	No. of Grinds Necessary per Piece	Time Consumed by Machine Operator per Piece Produced, in Minutes				Tool Grinding Time @ 2.6 Min.	Tool Dressing Time, @ 9.7 Min., 17 Grinds per Dressing	Cost per Piece								
									Direct Labor				Overhead			
		Changing of Dull Tools @ 1.7 Min. per Change	Handling Time	Machining Time	Total			Total Cost	Tool Dressing	Tool Grinding	Lathe Operation	Total	Tool Dressing	Tool Grinding	Lathe Operation	Total	Total
5	18.6	31.6	85.3	93.1	210.0	48.4	10.6	$0.22	$0.12	$0.57	$2.28	$2.97	$0.27	$0.96	$6.13	$7.36	$10.55
10	10.2	17.3	85.3	101.5	204.1	33.0	5.8	0.12	0.06	0.39	2.21	2.66	0.15	0.66	5.95	6.76	9.54
15	7.1	12.1	85.3	106.8	204.2	18.5	4.1	0.08	0.04	0.22	2.22	2.48	0.10	0.37	5.96	6.43	8.95
20	5.5	9.4	85.3	110.6	205.3	14.3	3.1	0.07	0.03	0.17	2.23	2.43	0.08	0.29	5.98	6.35	8.85
30	3.9	6.6	85.3	116.2	208.1	10.2	2.2	0.05	0.02	0.12	2.26	2.40	0.06	0.20	6.07	6.33	8.78
40	3.0	5.1	85.3	120.7	211.9	7.8	1.7	0.04	0.02	0.09	2.30	2.41	0.04	0.16	6.17	6.37	8.82
60	2.1	3.6	85.3	127.0	215.9	5.5	1.2	0.03	0.01	0.06	2.34	2.41	0.03	0.11	6.30	6.44	8.88
80	1.6	2.7	85.3	131.8	219.8	4.2	0.9	0.02	0.01	0.05	2.38	2.44	0.02	0.08	6.40	6.50	8.96
120	1.2	2.0	85.3	138.6	225.9	3.1	0.7	0.02	0.01	0.04	2.45	2.50	0.02	0.06	6.58	6.66	9.18
180	0.8	1.4	85.3	145.2	231.9	2.1	0.5	0.01	0.01	0.03	2.51	2.55	0.01	0.04	6.76	6.81	9.37
240	0.6	1.0	85.3	151.1	237.4	1.6	0.3	0.01	0.00	0.02	2.57	2.59	0.01	0.03	6.93	6.97	9.57
360	0.4	0.7	85.3	158.9	244.9	1.0	0.2	0.01	0.00	0.01	2.66	2.67	0.01	0.02	7.14	7.17	9.85

Tool dimensions.....14x3/4x1¼ in.
Minimum length of shank.....5 in.
Usable length of shank.....9 in.
Number of dressings per tool..... 10
Number of regrindings per dressing..... 17
Number of grinds per tool..... 170

Cost of tool @ $.60 per lb..... .....$2.00

Cost of tool per grind = $\frac{\$2.00}{170}$ = $0.0118

Time to redress tool.....9.7 min.
Time to redress tool.....2.6 min.

	Direct labor rate	Overhead rate
Tool dressing.....	$0.66	$1.50
Tool grinding.....	0.70	1.20
Lathe operation.....	0.65	1.75

given is substantially correct for ordinary shop operating conditions.

The total time consumed by the machine operator is the sum of the handling and machining time plus the time required for the changing of dull tools.

The tool grinding time is obtained by multiplying the number of grinds necessary per piece by 2.6 min., the time required for grinding one tool.

Tool dressing time is obtained by dividing 9.7 min., the time to dress a single tool, by 17, the number of grinds per dressing (these figures were obtained from "The Art of Cutting Metal") and multiplying the resulting time by the number of grinds necessary per piece, under the different life conditions.

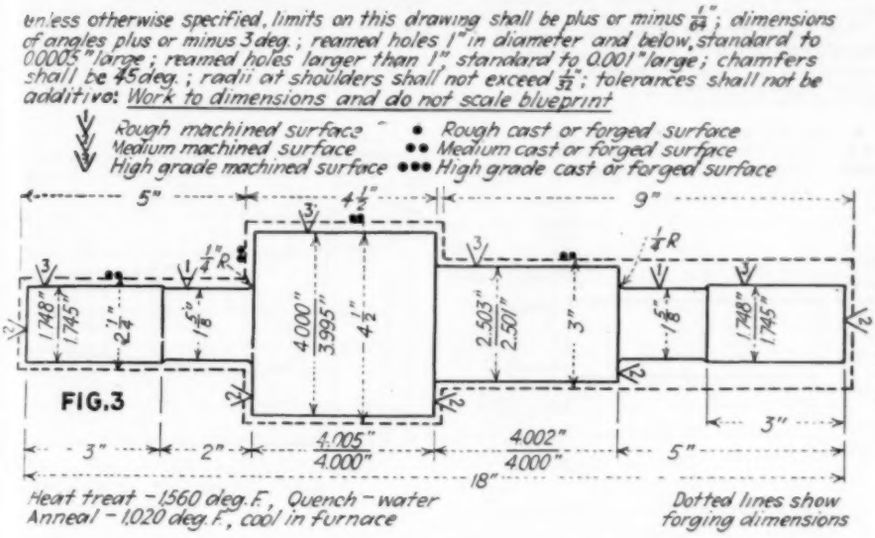
A tool cost per grind of $0.0118 is obtained by dividing the total cost of the steel in the tool by the total number of grinds it was possible to obtain from a single tool ¾ x 1⅛ x 14 in. long. A steel cost of $0.60 per pound was assumed. This cost per grind is multiplied by the number of grinds necessary per piece to secure a total tool cost per piece, given in column 9.

Direct labor costs are based on assumed hourly rates of $0.66 per hr. for smiths, $0.70 per hr. for toolgrinders, and $0.65 per hr, for lathe hands. The smith's rate is based on the average for a smith and a helper. We believe that these rates represent the average paid under wage incentive conditions, including any bonus paid.

The labor cost per piece for each operation is obtained by multiplying the equivalent time, for columns 8, 7 and 6 by the proper wage rate and dividing by 60, in the usual way. The total labor cost per piece is the sum of the tool dressing, tool grinding and lathe operation costs. Overhead rates of $1.50 per hour for tool dressing, $1.20 per hour for tool grinding and $1.75 per hour for lathe operation have been assumed. It is believed that these rates represent a low average for shops operating under scientific management. The overhead cost per piece for each operation has been calculated, using these rates, and the times given in columns 6, 7 and 8, and then summarized. The total cost per piece is then calculated by adding the tool cost, direct labor cost and overhead cost per piece, and is given in column 18.

A curve is then plotted, showing the

Fig. 3—Typical shaft turning job, SAE 1045 forged steel. Fig. 4—Cost chart for job shown in Fig. 3


unless otherwise specified, limits on this drawing shall be plus or minus 1/64"; dimensions of angles plus or minus 3 deg.; reamed holes 1" in diameter and below, standard to 0.0005" large; reamed holes larger than 1" standard to 0.001" large; chamfers shall be 45 deg.; radii at shoulders shall not exceed 1/32"; tolerances shall not be additive: Work to dimensions and do not scale blueprint
Rough machined surface
Medium machined surface
High grade machined surface
Rough cast or forged surface
Medium cast or forged surface
High grade cast or forged surface
5"
4 1/2"
9"
1/4 R
1.748" 1.745"
2 1/4"
1 5/8"
4.000" 3.995"
4 1/2"
2.503" 2.501"
3"
1 5/8"
1.748" 1.745"
3"
2"
4.005" 4.000"
4.002" 4.000"
5"
18"
Heat treat - 1560 deg. F., Quench - water
Anneal - 1,020 deg. F., cool in furnace
Dotted lines show forging dimensions
FIG.3

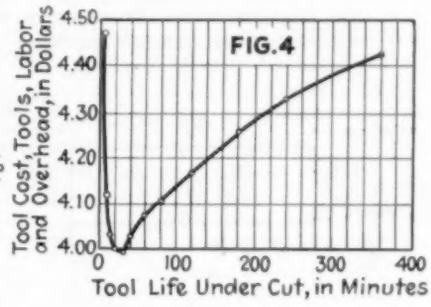


Table II—Costs for job shown in Fig. 3

Tool Life Under Cut in Minutes	No. of Grinds Necessary per Piece	Time Consumed by Machine Operator per Piece Produced, in Minutes					Cost per Piece			
		Changing of Dull Tools @ 1.2 Min. per Change	Tool Grinding @ 2.4 Min. per Grind	Handling Time	Machining Time	Total	Tool Cost	Direct Labor	Overhead	Total
5	7.0	8.4	16.8	50.5	34.9	110.6	$0.076	$1.192	$3.220	$4.488
10	3.8	4.6	9.1	50.5	38.0	102.2	0.041	1.108	2.980	4.129
15	2.7	3.2	6.5	50.5	40.1	100.3	0.029	1.087	2.921	4.037
20	2.1	2.5	5.0	50.5	41.5	99.5	0.023	1.079	2.900	4.002
30	1.5	1.8	3.6	50.5	43.7	99.6	0.016	1.080	2.903	3.999
40	1.1	1.3	3.1	50.5	45.3	100.2	0.012	1.088	2.921	4.021
60	0.8	1.0	2.4	50.5	47.7	101.6	0.009	1.102	2.962	4.073
80	0.6	0.7	1.7	50.5	49.4	102.3	0.007	1.110	2.985	4.102
120	0.4	0.5	1.2	50.5	51.9	104.1	0.004	1.129	3.035	4.168
180	0.3	0.4	1.0	50.5	54.6	106.5	0.003	1.155	3.107	4.265
240	0.2	0.3	0.7	50.5	56.7	108.2	0.002	1.172	3.154	4.328
360	0.2	0.2	0.5	50.5	59.6	110.8	0.002	1.200	3.227	4.429

Toolbit dimensions ..... 4½x½x⅜ in.
Minimum length of shank ..... 1½ in.
Usable length of shank ..... 3 in.
Number of dressings per tool 3
Number of regrindings per dressing 16
Number of regrindings per tool 48
Cost of toolbit @ $1.05 per lb., weight, ¾ lb. $0.52
Cost of tool per grind — $0.52 ÷ 48 = $0.0108
Direct labor rate ..... $0.65 per hour
Overhead rate ..... $1.75 per hour

total processing cost of the part as a function of the tool life under cut, which is shown in Fig. 2.

It will be evident that the lowest cost per piece for the conditions assumed is obtained when cutting speeds are so set as to secure a tool life under cut of 30 min. In this particular instance the point of lowest cost is very definite, and the total cost of the part is appreciably increased when any appreciable deviation is made from this tool life.

Part No. 2, shown in Fig. 3, is somewhat lighter than the one shown in Fig. 1. It is assumed that this part is machined from a rough forging, so there is not as great a volume of metal to be removed as there was in the case of the first part. A tool bit, ⅝ x ⅝ in., held in an Armstrong tool holder and made of standard 18-4-1 high speed steel is to be used in machining this part. The part is to be finished complete on the lathe without grinding. In this case it is assumed that the lathe operator grinds his own tools, using a floor stand located reasonably close to the lathe, so that little time is wasted in walking to and from it. Under these circumstances, it is usual practice for an operator to do all grinding while tools are out of the tool holder because the end of a cut had been reached. However, it is desirable, for the sake of uniformity, to make the calculations for this part on the same basis as was adopted for part No. 1. This method will probably give results that are substantially correct for customary good shop practice.

As the operator does all tool grinding, and it is not necessary to dress the tool bits used, all direct labor is performed by the lathe operator.

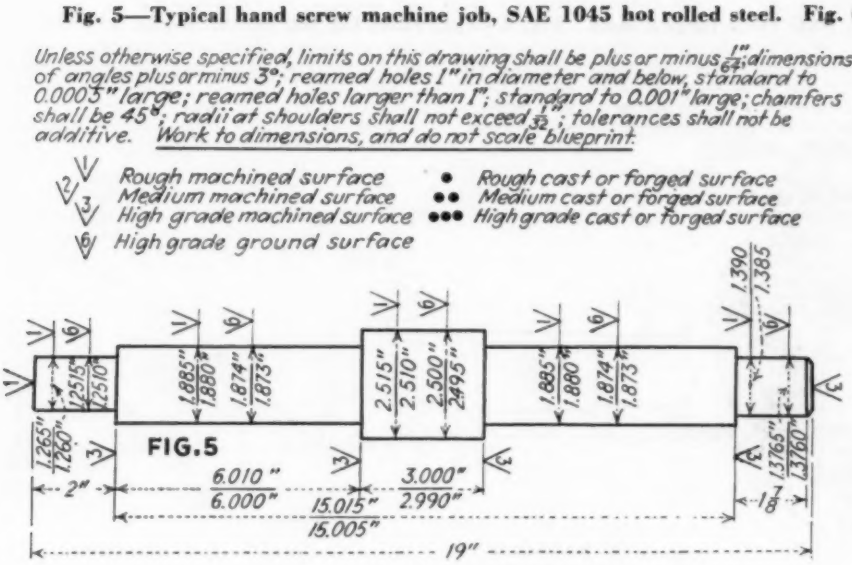
Let us assume the cost of the tool bit to be $1.05 per lb., or $0.52 for a bit ⅝ x ⅝ x 4½ in. This seems to represent a typical present-day cost of such a tool. We have no data as to the number of grinds which can be obtained from a single bit, but it is doubtful whether it would be possible to get more than 48. This gives a cost per grind of $0.0108. This ⅝-in. bit does not have the cutting capacity of the ¾-in. tool used in Fig. 1, so that the cost per grind for equivalent cutting capacity is greater for a toolbit than for a forged tool. However, there are circumstances under which use of tool bits is indicated, particularly where it is difficult to get proper heat treatment of tools because of lack of facilities.

The calculations on which Table II are based are similar to those used in figuring Table I, and the labor and overhead rates are the same.

Results are plotted in Fig. 4. It will be noticed that the type of curve is identical with that shown in Fig. 2, for part No. 1. Note also that a minimum cost is again secured with a tool life under cut of 30 min.

The gear shifter shaft, shown in Fig. 5, is rough finished on a hand screw machine, for final finishing by grinding. Calculations are made as for part No. 1, except that an hourly rate of $0.60 is assumed for the machine operator. Unformed bar steel is used for a tool, but it is assumed that there is a heat treatment cost of $0.25 per tool, which applies only once in the course of its life. All tools are to be ground in the toolroom. The curve plotted for the data

Fig. 5—Typical hand screw machine job, SAE 1045 hot rolled steel. Fig. 6—Cost chart for job shown in Fig. 5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Rough machined surface
Medium machined surface
High grade machined surface
High grade ground surface
Rough cast or forged surface
Medium cast or forged surface
High grade cast or forged surface
1.885" 1.880"
1.874" 1.873"
2.515" 2.510"
2.500" 2.495"
1.390" 1.385"
1.265" 1.260"
1.251" 1.250"
1.3765" 1.3760"
FIG.5
6.010" 6.000"
3.000" 2.990"
2"
15.015" 15.005"
1 7/8"
19"

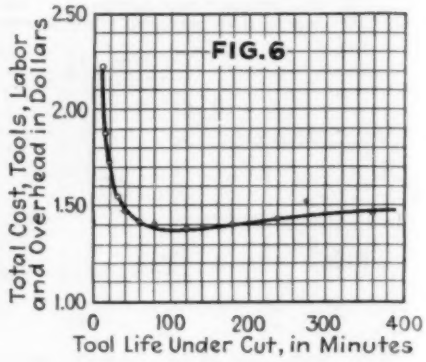


Table III—Costs for job shown in Fig. 5

Tool Life Under Cut In Minutes	No. of Grinds Necessary per Piece	Time Consumed by Machine Operator per Piece Produced in Minutes: Changing of Dull Tools @ 13.2 Min. per Change	Handling Time	Machining Time	Total	Tool Grinding Time, @ 2.6 Min.	Cost per Piece: Tool Cost	Direct Labor: Tool Grinding	Direct Labor: Lathe Operation	Direct Labor: Total	Overhead: Tool Grinding	Overhead: Lathe Operation	Overhead: Total	Total
10	2.13	28.1	2.7	21.3	52.1	5.5	$0.020	$0.064	$0.521	$0.585	$0.110	$1.518	$1.628	$2.233
15	1.49	19.7	2.7	22.3	44.7	3.9	0.014	0.046	0.447	0.493	0.078	1.300	1.378	1.885
20	1.17	15.5	2.7	23.3	41.5	3.0	0.011	0.035	0.415	0.450	0.060	1.209	1.269	1.730
30	0.81	10.7	2.7	24.4	37.8	2.1	0.007	0.025	0.378	0.403	0.042	1.102	1.144	1.554
40	0.63	8.3	2.7	25.3	36.3	1.6	0.006	0.019	0.363	0.382	0.032	1.058	1.090	1.478
60	0.44	5.8	2.7	26.6	35.1	1.1	0.004	0.013	0.351	0.364	0.022	1.022	1.044	1.412
80	0.35	4.6	2.7	27.6	34.9	0.9	0.003	0.011	0.349	0.360	0.018	1.018	1.036	1.399
120	0.24	3.2	2.7	29.0	34.9	0.6	0.002	0.007	0.349	0.356	0.012	1.018	1.030	1.388
180	0.17	2.2	2.7	30.5	35.4	0.4	0.002	0.005	0.354	0.359	0.008	1.031	1.039	1.400
240	0.13	1.7	2.7	31.7	36.1	0.3	0.001	0.004	0.361	0.365	0.006	1.052	1.058	1.424
360	0.09	1.2	2.7	33.3	37.2	0.2	0.001	0.002	0.372	0.374	0.004	1.085	1.089	1.464
500	0.07	0.9	2.7	34.7	38.3	0.2	0.001	0.002	0.383	0.385	0.004	1.118	1.122	1.508

Tool dimensions	8x5/8x1¼	Number of regrindings per tool	140	Direct labor rates—Tool grinding	$0.70
Minimum length of shank	3 in.	Cost of tool	$1.07	Lathe operation	$0.60
Usable length of shank	5 in.	Cost of heat-treatment	$0.25		
Number of dressings per tool	7	Total cost	$1.32	Overhead rate—Tool grinding	$1.20
Number of regrindings per dressing	20	Cost of tool per grind	$0.0094	Lathe operation	$1.75

of Table III is shown in Fig. 6. In this case the minimum cost is secured with a tool life somewhere between 100 and 120 min., and the increase in cost with increasing tool life under cut is not as rapid as is the case in Figs. 2 and 4. Nevertheless, there is a definite point of minimum cost, and the total cost of the part increases appreciably when any deviation is made from this point.

The same method should be used when it is desired to determine which tool material is most economical for a given use. Different material costs per pound, and tool grinding times, would undoubtedly be necessary, while it may be necessary also to change the numbers of grinds which may be secured for a tool of given size. In the case of brittle tool materials, where chipping of the cutting edge is relatively frequent, it will be desirable to include an allowance, not only for the loss of material, but for the increased grinding time necessary to make the tool again useable.

Other work, which is not shown here, indicates that, for those cases where the tool cost is inappreciable in comparison with the direct labor and overhead costs, lowest costs are secured when the tool life under cut is six to seven times the time required to change, dress and grind tools. This checks well with a figure of seven times deduced mathematically by Taylor.

While all of our illustrations have been taken for turning jobs, absolutely the same method is applicable for any other type of tool. The author is unfamiliar with any data showing just what tool life is desirable for the various types of tools. There has been a general belief that a 60- or 90-min. life is best for turning tools. However, it has been shown that this is undoubtedly high, except for screw machine work.

There is one caution that must be applied in making such a calculation. The power of the machine does not enter into the results, consequently it may be found that the machine is unable to pull a cut which may be the one indicated as giving the lowest overall costs for a given size of tool. Under such considerations, further calculations must be made to determine whether it may be cheaper to drop the speed to one which the machine can pull, or to purchase a new machine. It is believed that this question will come up most frequently when comparing some of the new materials, such as tungsten carbide and stellite, with high speed steel.

It will be noticed that the tool life under cut giving the lowest overall cost does not give the lowest tool cost. As a matter of fact it will be seen that the tool cost per piece is several times greater at a tool life of 30 min. than at a tool life of 200 min., in spite of the fact that total cost is appreciably lower. This is shown clearly in Fig. 7 which is made by plotting pounds of tool steel used per pound of chip produced under various conditions of tool life. It is obvious that economy of tools is not necessarily an economic use of tools. Minimum costs can only be obtained when there is exact knowledge of the possible performance, and when the workmen are given information that makes it possible

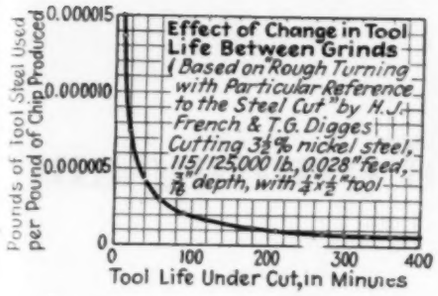

Effect of Change in Tool Life Between Grinds
(Based on "Rough Turning with Particular Reference to the Steel Cut" by H. J. French & T. G. Digges
Cutting 3½% nickel steel, 115/125,000 lb., 0.028" feed, 3/16" depth, with ¼"x½" tool
Pounds of Tool Steel Used per Pound of Chip Produced
0.000015
0.000010
0.000005
0
0
100
200
300
400
Tool Life Under Cut, in Minutes

Fig. 7—Effect of change in tool life between grinds. Based on "Rough Turning With Particular Reference to the Steel Cut," by French and Digges. Cutting 3½% nickel steel, 115/125,000 lb. per sq.in. tensile, 0.029-in. feed, 3/16-in. depth of cut, ¼x½-in. tool

for them to conform to the best possible standard. There are far too many variables for any one man to be consistent in achieving lowest cost conditions without records of any kind.

It is amazing that machine shop management has failed to recognize the importance of this element of machine shop operation and has assumed little or no responsibility with respect thereto. The best engineering talent has been brought to bear upon the design and potential efficiency of machine tools purchased but in the matter of cutting tools and of speeds and feeds management has been content to pass the buck to the workman.

Profits Depend on Knowledge

In the past there has been too much of a tendency to consider the work of the machine shop as an art. Little specific data was available as to speeds and feeds which should be used under any particular set of circumstances and little effort has been made to make full use of such data as has been available. Today it is necessary, not only to have such data available, but to make full use of it, if a plant is to survive. It is not enough to think that you know. The shop that will get business during these next few years will know not only whether its product is designed to be manufactured with the available equipment most effectively, and that the equipment is that which gives the lowest overall costs, including depreciation, repairs and obsolescence, but that all equipment and tools are operating at their most effective point. Unless all these things are done, some other shop is likely to take away the available business because it can manufacture at a profit at prices which are less than the costs of the less efficient shop.

Idle Time—What Shall We Do With It?

Discussion

ROBERT S. ALEXANDER

The three articles published under the above heading (*AM*—Vol. 77, page 265), to my mind, represent a real attempt to come to grips with a problem which has been growing steadily in importance with the progress of mechanization—what to do with enforced idleness, or if you prefer it, leisure.

Undoubtedly, as Mr. Rheinstein suggests, the plan which he outlines can be adapted to fit the needs of any manufacturing concern. Properly handled and organized, I see no reason why it should not be profitable to industry to allow the worker in one department of a factory, a chance to familiarize himself with the rest of the processes that go to make up the finished product.

It has been my experience, particularly in large plants, to hear workmen with years of experience in one department express ignorance as to how the other parts of the product which passed through their hands were fabricated. In the majority of cases, the men were given little or no encouragement to go beyond the confines of their own section, with transfers to other departments frowned on by a too rigid production policy. With the result that many a square peg—in an occupational sense—had perforce become accustomed to the round hole in which he had been placed, often at the expense of the hole.

With a carefully budgeted expenditure of leisure time, the men who were really interested in improving their knowledge of a company's product could acquire that knowledge under ideal conditions—right in the plant. Which would make for a more efficient and "flexible" personnel.

In the machine shop, for example, some members of the engineering staff could be recruited for the purpose of imparting to the shopman instruction in shop mathematics, blue-print reading, shop sketching or mechanical drawing. Incidentally it is surprising how many draftsmen and designers there are who lack the ability to operate even the simplest machine tools. Here is an opportunity for the shopman to reciprocate in the matter of tuition, so that future designs would eliminate unnecessarily intricate machining problems!

Another suggestion, I believe quite in keeping with the trend of present day practice, would be a class in model making. The growing popularity of using models as a check on design seems to indicate that such a course would prove highly profitable. In this connection I recall, during my apprenticeship days in a large locomotive shop, a secluded part of the plant which we dubbed "the white elephant shed." In it was housed a 50-ton electric locomotive—built to run by storage batteries—a costly failure. Had the inventor's plans been first executed on a model scale, as would be the case today, many thousands of dollars would have been saved.

Then, too, the making of models would provide an opportunity for the junior draftsmen in "scaling down" and making model assembly drawings, which to the youngster employed on routine detail work, tracing, etc., would be fascinating as well as educational.

Viewed from any angle, a carefully planned leisure time program is full of beneficial possibilities for all ranks of industry, employer and employed. To quote Mr. Rheinstein, "The by-products of that plan may well emerge more important than the direct results." If only for the fact that such a scheme must inevitably widen the horizon of each man's field of endeavor and instil a feeling of tolerance and respect for the problems of his neighbor, it is well worth the consideration of thoughtful industry.

In conclusion, I would like to comment on the article by P. H. Bryant, "An Individual's Reply." To me it represents a convincing argument in favor of a scheme of industrial insurance, whereby the worker—of any degree of skill—could be assured of at least the necessities of existence during a period such as we are passing through.

This in no way detracts from my admiration of the individual—and the party of the second part—who entered into the "retainer" agreement. Both deserved to benefit, and undoubtedly both did. Yet, in my opinion, the day is not far distant when industry's "new deal" will yield to the long over-due necessity of installing a workable plan of industrial employment insurance, possibly in collaboration with leisure time educational programs.

I am sure readers of *AM* will agree with me in saying that the editors are to be commended on recognizing the problem which enforced leisure presents, and placing it in such a thought provoking manner before the public.

Continuous Punching, Forming and

Multi-slide machines produce a multiplicity of small parts and die changes are relatively inexpensive

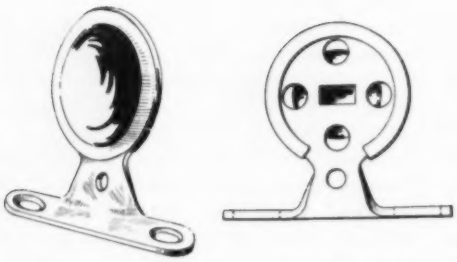


Fig. 1—Bracket for automobile shade roller made complete at one operation

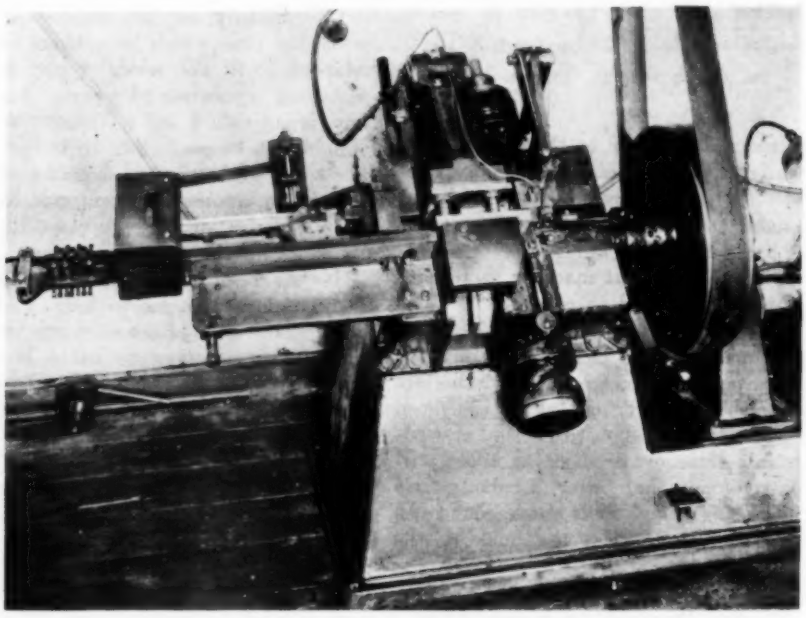
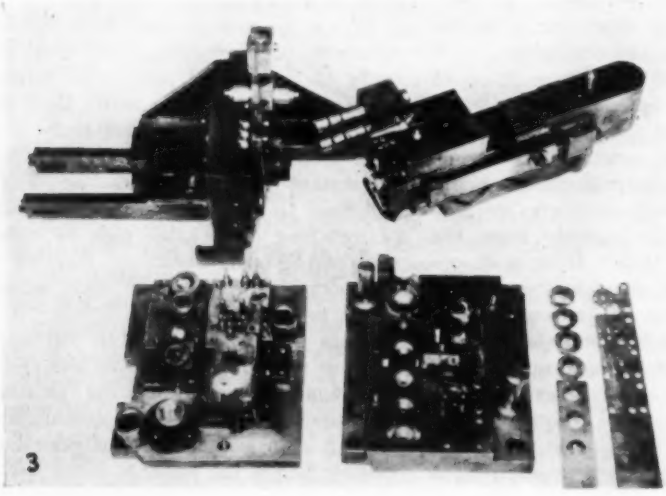


Fig. 2—Heyman machine on which the shade roller bracket is made at the rate of 100 per min.

Fig. 3—Details of the dies used in making the bracket and showing how strips are formed. Fig. 4—Dies for making two-part wheels for metal top



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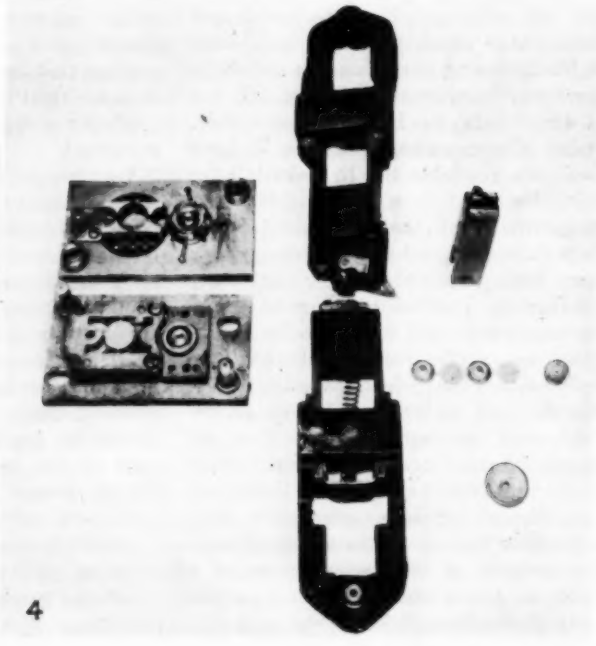

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Assembling on Automatic Machines

FRED H. COLVIN
Editor, American Machinist

PUNCHING, stamping and forming operations have long played their part in reducing the costs of manufacture, especially in small articles that are used in large quantities. Pins, hooks, buckles and a host of other articles have long been made in automatic machinery that takes the wire or strip in at one end and delivers the finished parts at the other at an astonishing rate. But in spite of what seemed to be perfection in many of these operations, inventors and designers have not rested on their laurels but are constantly devising new and better methods of doing the old job, or of taking over work that seemed to belong to another field.

One of the most interesting improvements is the combination of operations. These frequently involve the making of two or more parts from separate pieces of metal, and assembling them before they leave the machine. In other instances fairly intricate parts are made from a single piece, but punched and formed into a complete unit during a single operation. Several examples of recent accomplishments along various lines are illustrated herewith.

Punching and forming more or less intricate shapes is common practice in many shops. There are also many interesting examples of assembling units into a complete whole after the parts are stamped. The making of hinges from a strip, rolling the eyes and assembling complete before they leave the machine, is one of the best known illustrations of this kind of work. Snap button machines are also interesting examples.

A somewhat different line of work, made in one operation on a modern machine, is shown in Fig. 1. This is a shade roller holder for closed cars, and makes a very good looking piece of automobile hardware. It drops out of the press, with both parts blanked, formed and assembled as shown, at the rate of 100 per min. These are made on the new machine of the Heyman Machine Co., Irvington, N. J., as shown in Fig. 2. The dies are shown in Fig. 3. Two strips of metal are fed into the machine, shown at the right, the wider strip making the bracket and the other the cover. The tools are also illustrated. These tools are so lined up that a bracket and a cover, or cap, are in the center of the forming tools at each stroke of the press. The bracket is then cut off and forced down on the cap. The cap is cut out of the strip and drawn into the front tool, the edge being folded over the bracket. At the same time the foot of the bracket is formed at a right angle. Then the front plunger pushes the combination into the back tool where the final closing of the edge is completed and the finished piece is pushed out into the air jet that blows it out of the way. The front tool is piloted in the angle plate to insure the tool against damage.

Another forming and assembling job is shown in Fig. 4, these being small metal wheels for toy vehicles, made complete at one stroke. Both parts are punched from the same strip, the smaller piece, or disk, being folded against the wheel at the proper time. The plunger slide draws the rim of the wheel into the front tool after the two parts are cut apart and trimmed. The front plunger then pushes the two parts into the outer portion of the back tool, and closes the edges of the wheel over the center disk. The completed wheel is positively ejected at the rate of 120 per min.

The Hyman machine, Fig. 2, differs from the others shown in having an inclined bed and in using barrel, instead of face cams. As with the others, slides can be added at various points to perform almost any operation that may be required. The ram, with bolster and flywheel, resembles a standard punch press and can be operated in single strokes, or continuously, as necessary. The forming portion of the press is near the ram. The ram is used only for

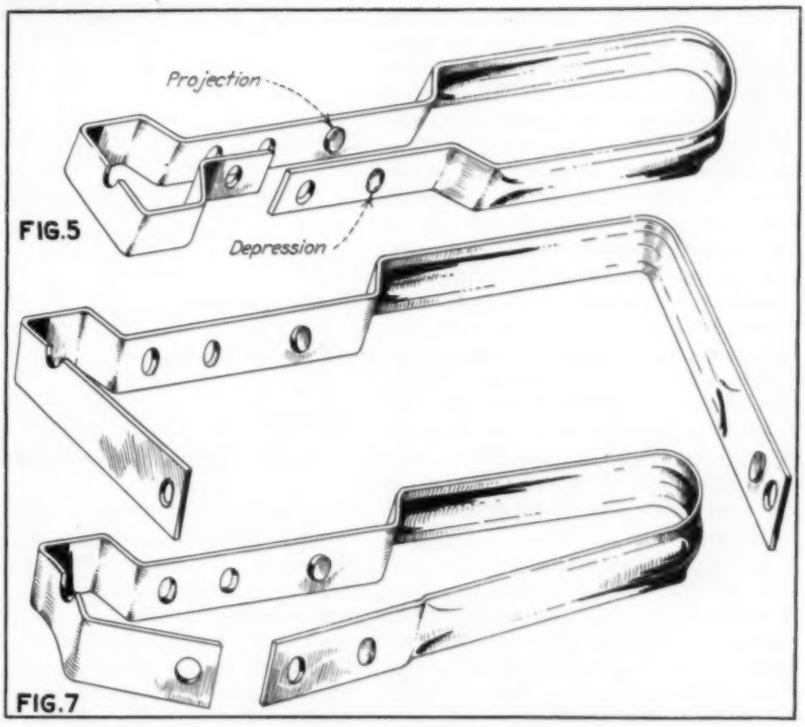


Fig. 5—Can opener handle as it comes from the U. S. machine. Fig. 7—Two stages of the bending operation

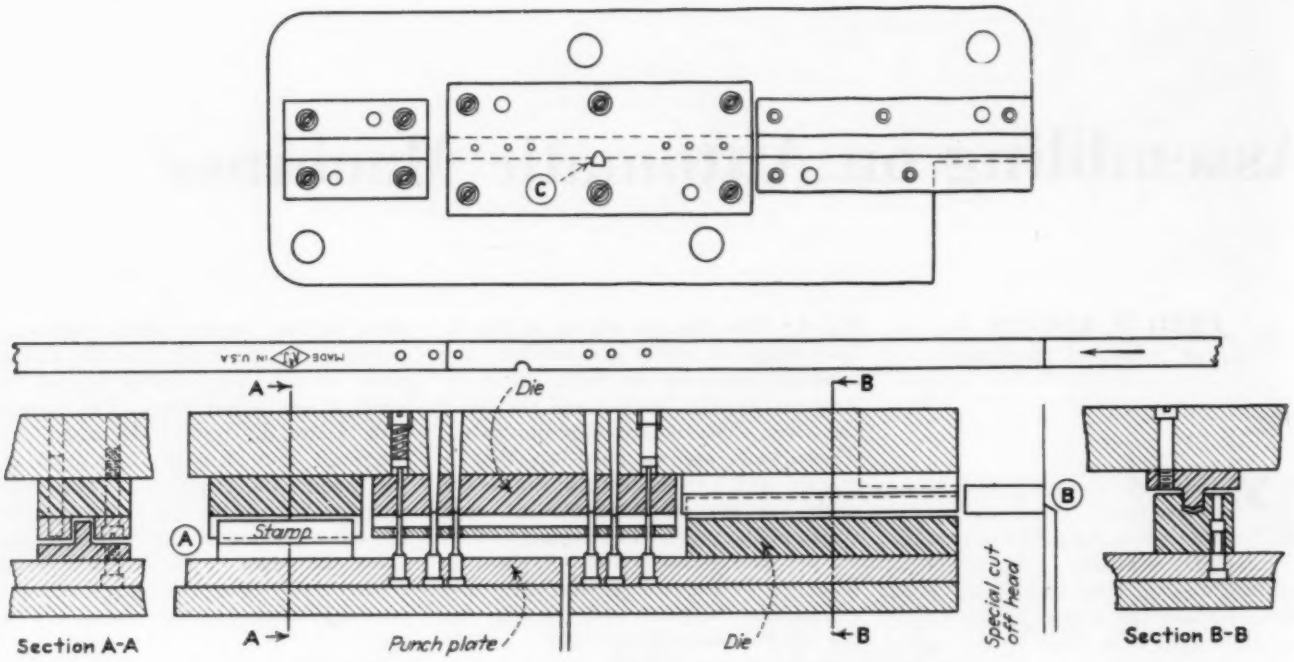


Fig. 6—Dies for punching and forming the handles from strip steel

piercing, blanking or embossing and has a very short stroke which gives a slow cutting speed and a long life to punches and dies. An unusual feature of the ram is the very slight taper of the sliding fit, so arranged that the ram and guides have a metal to metal fit at the end of the stroke. This insures accurate matching of punches and dies. Mention is made of blanking over a million pieces of 0.050 in. cold rolled steel without grinding the dies.

The U. S. Tool Company, Ampere, N. J., also builds a forming machine that turns out very interesting products. An example is given in the can opener handle shown in Fig. 5, which is made of flat strip steel, fed from a reel. The stock feeds into the tools, Fig. 6, which shows the die used, before the first stroke of the press. This stroke forms the handle, Section B-B, and also punches the first four holes. The slug of rear hole is pushed half way back in the strip to form a stop and hold the sides apart wide enough to receive the hooked blade of the can opener. At the same stroke the punch *C* cuts out the V-shaped notch that goes over the edge of the can. The dotted outline of the strip below the die shows its position and appearance after the first stroke of the press.

At the next feed movement the back end of the handle, which has been sheared off at *B*, is moved ahead by the advance of the strip that forms the next handle. This is also indicated by strip shown between the dies. The next stroke of the press punches the end hole with its punch and forces out the projection with the spring-backed punch shown.

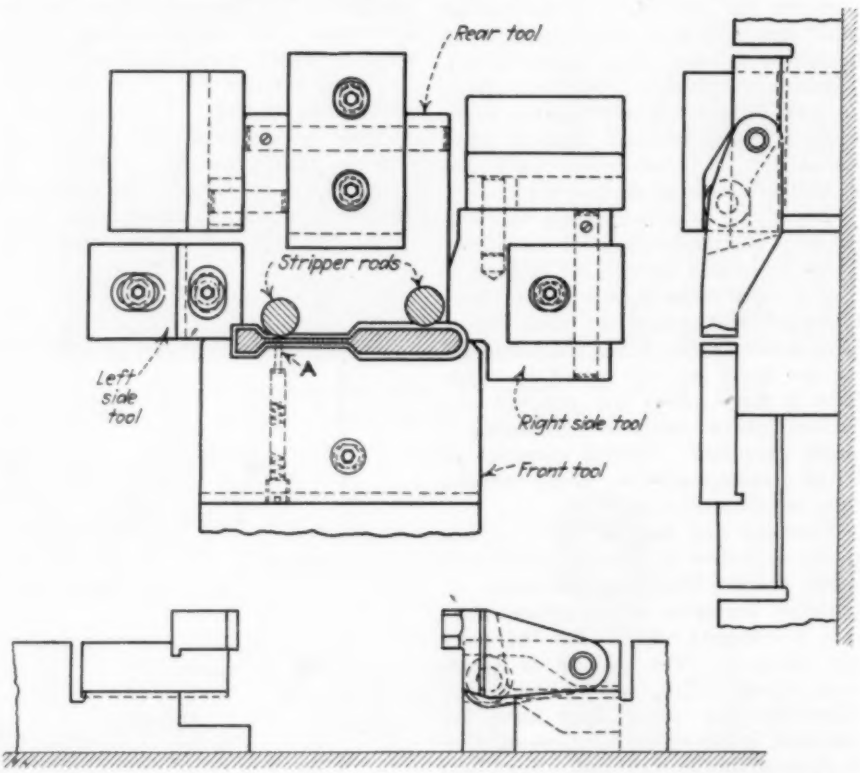


Fig. 8—The forming or bending tools showing spring pin for locating handle

This matches the projection previously formed when the handle is bent into shape. At the same time any desired imprint is made on the handle by the stamp indicated.

The strip which is to form the handle then goes to the bending mechanism, which is part of the same machine and in direct line with the punches and die shown, and is formed in stages seen in Fig. 7. The first bend is shown above, the side tools dropping out of the way while this is being done. They then rise into position and force in the sides, so that the rear tool can complete the shaping of the handle. The first bends are shown ready for the final kinking of the ends, Fig. 5, that will be ready for riveting the knife in place. The bending is done around a former or anvil as in Fig. 8. The strip is located by the spring-backed pin *A* which enters

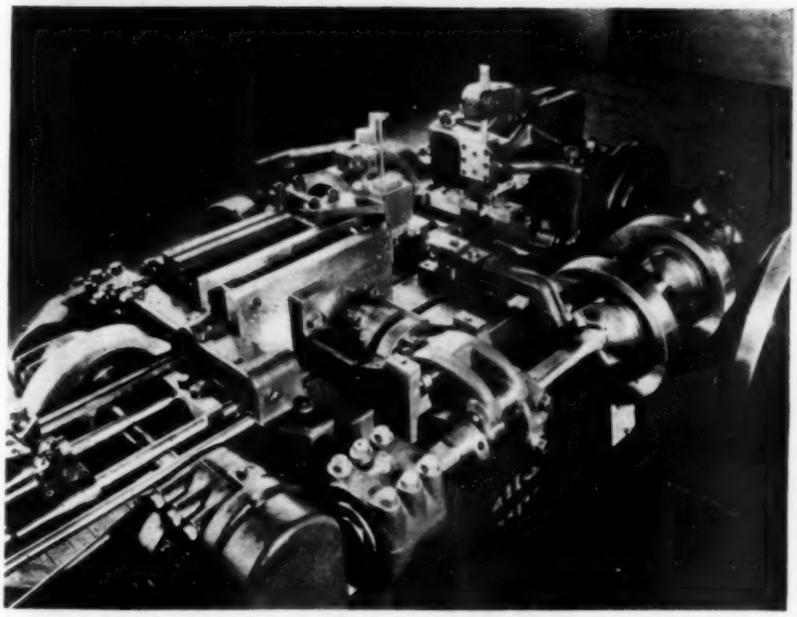


Fig. 9—Close-up of machine made by the U. S. Tool Co., showing cams and slides

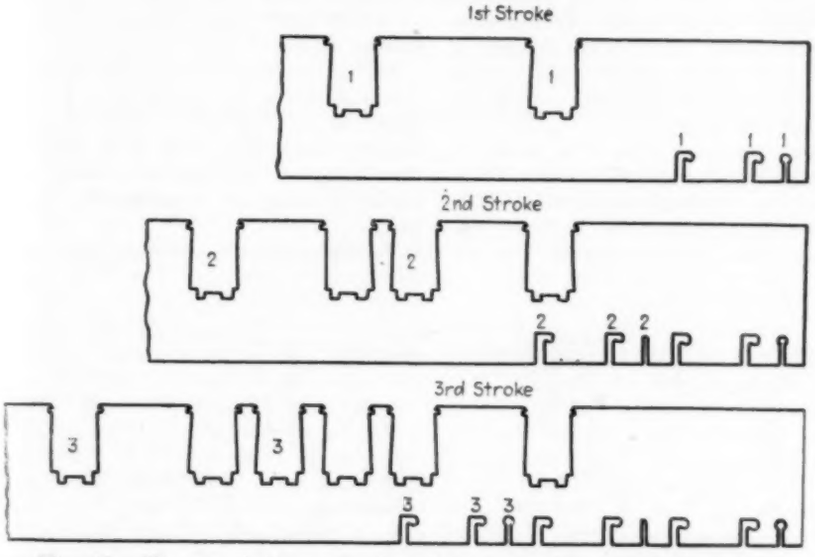


Fig. 11—The punch layout to show how successive operations give a complete socket

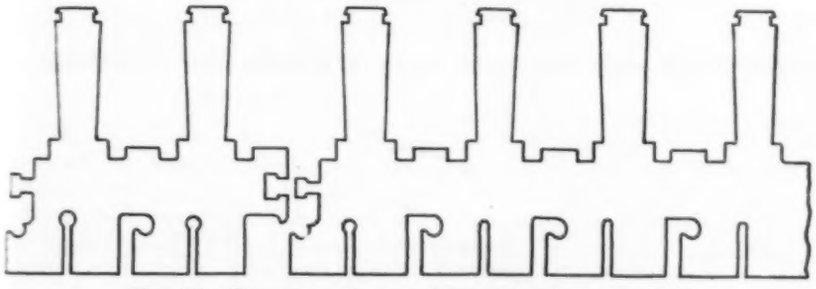


Fig. 12—How the strip was sheared to give a positive lock when rolled and completed

the hole nearest the head and positions the strip during the bending operations. The bending is so effective that there is very little spring at the ends when the handle comes off the machine. The completed handle is stripped from the end of the former by the rods shown. These handles are made complete at the rate of 85 per min. The construction of the U. S. machine is seen in Fig. 9.

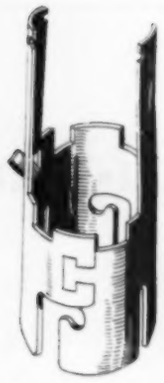


Fig. 10—Automobile lamp socket punched and formed at one operation

In Fig. 10 is a special lamp socket for automobile headlights. These sockets are made from strip brass at the rate of 90 per min. While the bulk of the work is done in a progressive die, the rolling of the sheared blank so that it locks itself into a cylinder makes it a complete unit as it leaves the machine. The tools and methods used are of interest. This strip, Fig. 11, shows the operations and the numbers, the sequence in which they are performed. All the openings marked 1 are punched at the first stroke of the press. Then the strip moves along and the next stroke punches the openings marked 2, while the first punches are repeating.

One interesting feature is the form or outline of the shear at the end of each piece, Fig. 12, as this provides the method of locking the ends together when the strip is rolled into a circle to make the socket. The T-shaped tongue on one piece makes a substantial lock and makes the socket practically a solid piece. The notches at the base of the prongs lock the socket against turning while the small projection thrown out at the side locates the depth it goes into the lamp. This is made on a machine of the A. H. Nilson Company, Bridgeport, Conn. It adds an interesting example of what can be done by men experienced in this line of work.

Trays for Bottles

STANLEY BALDWIN

Workmen who like to keep their benches neat and orderly will appreciate a photographic developing tray of rubber or composition, or a shallow tray of sheet lead, as a receptacle for bottles containing soldering flux, etching and coppering solutions and other acids.

Enameled-ware trays are not good for this purpose, as acids spilled on them will eat away the enamel.

Multi-Blade Cutting Tools

Their Design and Use—IV

R. R. WEDDELL
The O. K. Tool Company

Facing tools and such details as tool angles, number of blades, power required, blade adjustment, speeds and feeds, use of pilots and chip breakers are considered

FACING involves certain considerations of tool design not found in other metal-cutting operations. A faced surface may be machined by a single-point tool gradually fed across it, or it may be finished with a wider tool brought into position to cut the whole surface at once. In multi-blade facing heads, several wide cutters operate at one time.

In speaking of the cutting angles of a facing head in relation to the axis of the cutter, they may be regarded as opposite to those of a boring cutter. In Fig. 23, the rake angle is on the periphery of the cutter while the spiral angle is measured in the plane of the face. A positive rake is recommended for most materials, cast iron as well as steel, to reduce the heavy load required for feeding. This may be modified if the tool tends to chatter or dig. The spiral angle on the face of the tool should be negative; that is, the cutter blade should be set ahead of center. This will cause the chip to crowd out and away from the center. Fig. 24 shows the spiral action for blades of different settings in relation to the radial center line.

The adjustment of facing blades as in other cutters should be in the direction of feed; that is, they should be moved forward from the face of the body instead of radially, as in a boring head, where sizing the diameter is all important.

Facing calls for heavy pressure against the surface. The total width of chip is considerable, and all refinements of tool design should be considered to gain the maximum cutting efficiency. Fewer blades should be used than in a boring tool. The cuts, especially if wide, demand a heavy pressure for feeding, and it is obvious that the more blades there are, the more power will be required to take the cut. Therefore, facing heads should have comparatively few blades. Better results will be obtained, too, by having an odd number of blades in the cutter. A few blades will make the action truly a cutting one. If there are many, the feed means on the usual machine tool is not adequate. Facing with a many-bladed cutter tends toward a scraping operation, which quickly dulls or nicks the teeth and will not result in a smooth finish.

Ample provision should be made in a facing cutter for chip clearance. Where the chip is wide and considerable scrap metal is being made, the body is generously grooved as shown in Fig. 23. Nicks in the teeth, staggered, further break up the chip and assist in its movement from under the face of the cutter blade.

Facing heads operate at the same cutting speeds as boring tools. The feed is a trifle less but still great enough to insure a positive cutting action. Speed and feed tables for facing with high speed steel are shown below:

CUTTING SPEEDS

Brass	120 ft. per min.
Cast iron	50 " " "
Mild steel (0.10-0.20 carbon)	60 " " "
Steel (0.30-0.40 carbon)	50 " " "
Alloy steel	40 " " "
Steel casting	40 " " "
Malleable iron	60 " " "
Aluminum	250 " " "

CUTTING FEEDS

To 3 in. diameter	0.015 in. per rev.
3 to 6 in. diameter	0.010 " " "
6 in. diameter and up	0.005 " " "

As stated previously, facing heads require considerable power to function satisfactorily. Therefore amply large keyways should be provided. Keys should be located against a solid shoulder and be driven through an end keyway.

Facing heads are made with the bore design as in Fig. 23, or may have a solid shank as in Fig. 25. They may be further fitted with pilots as in Fig. 26 for facing off the top of a boss, the cutter locating in a previously bored hole.

Facing heads are combined with bor-

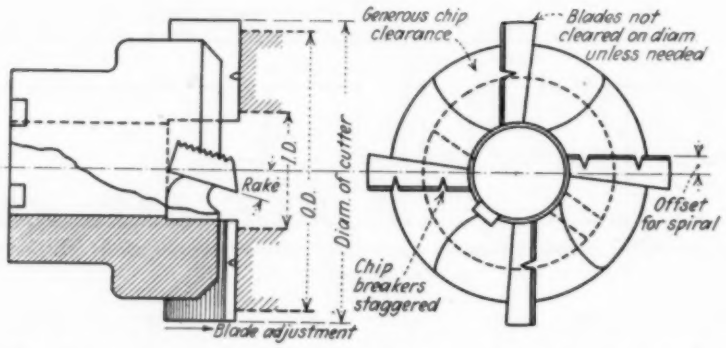


Fig. 23—Cutting angles and general design for a facing head are indicated

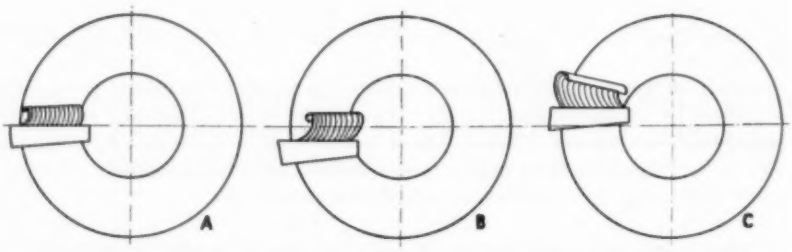


Fig. 24—At *A*, with the blade on center and no spiral action, the chip piles up on the blade. At *B*, with the blade back of center, the spiral action crowds the chip toward the center. At *C*, with the blade ahead of center, the spiral action crowds the chip out from the center

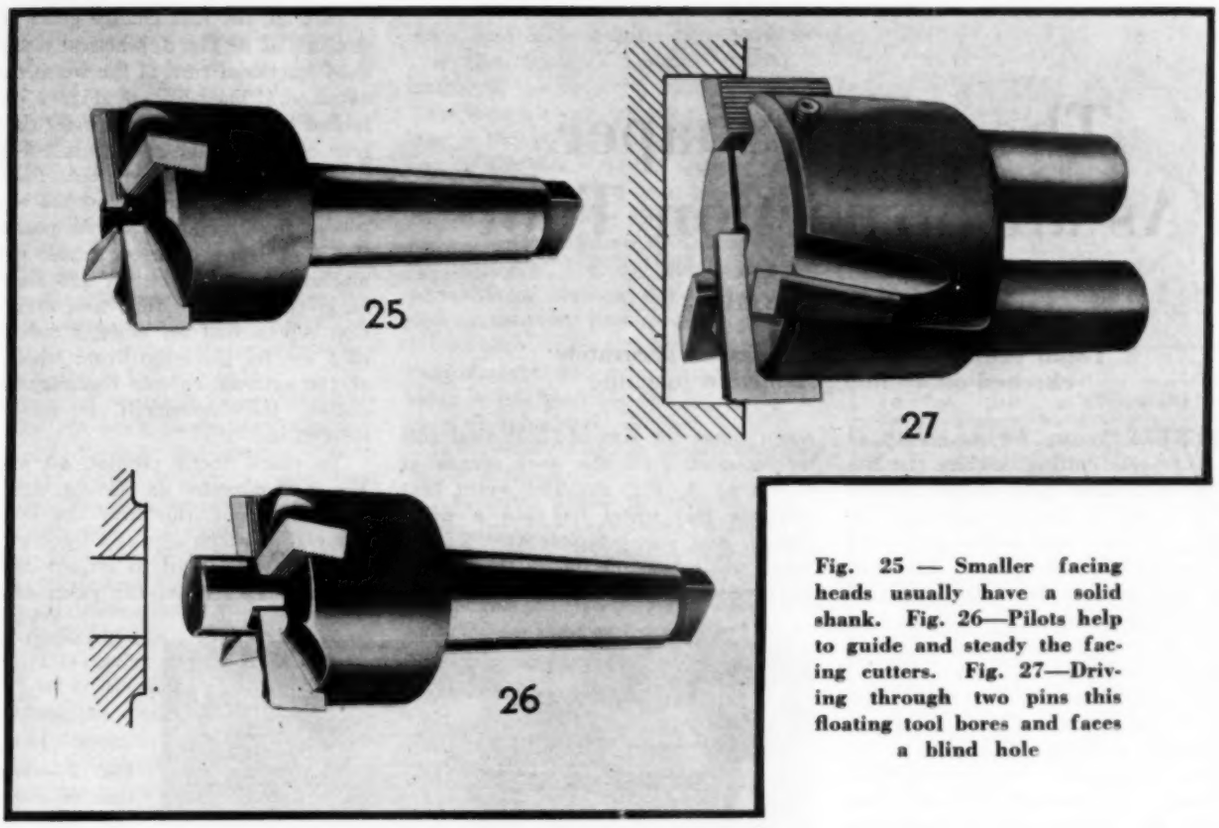


Fig. 25 — Smaller facing heads usually have a solid shank. Fig. 26—Pilots help to guide and steady the facing cutters. Fig. 27—Driving through two pins this floating tool bores and faces a blind hole

ing heads as described in previous articles. Another odd combined facing and boring tool is shown in Fig. 27 for boring a blind hole. Three boring blades and one wide facing blade are used. The latter is set on a radial line and passes across the center. This permits it in one revolution to sweep the whole bottom surface of the blind hole. The tool floats, the drive being through two pins fitting loosely into holes in the drive spindle. The screw shown is set to the desired diameter when grinding to allow for gaging the odd number of blades. The screw is removed when the cutter head is in use.

How Hot Should a Bearing Run?—*Discussion*

C. G. WILLIAMS

"How hot should a bearing run?" asks John R. Godfrey (*AM*—Vol. 76, page 1171). This is a mooted question, but the best authorities seem to hold that a well designed bearing using a lubricant of the proper viscosity, in the proper amounts, should not register a temperature of the bearing higher than 30 deg. F. above room temperature.

It may, however, be more economical in winter to use a lower viscosity lubricant, and thus generate enough heat in the bearing so that the lubricant may be kept sufficiently warm to give its best effects under these conditions. This may make the bearing run 150 deg. F. above room temperature, and yet not cause the bearing to "run hot."

I have designed bearings for a speed of 50,000 r.p.m. with a clearance such that a wedge shaped film of oil could be held between the shaft and the bearing, and yet the shaft would show no chatter, the bearing indicating but 30 deg. F. above room temperature. I have also designed heavy duty bearings where the bearing must be held to the minimum of size, and yet run 24 hrs. per day for six months, at a continual temperature of 300 deg. F., and yet the bearing would not cut to any degree. It wore slowly, of course, but the condition of both shaft and bearing permitted them being closed slightly and the machine again started for months of service.

I have seen papermill machinery run for months at a bearing temperature of 350 deg. F., and wood pulp grinders run continuously for seven months with a bearing temperature of 450 deg. F. at about 275 r.p.m. and a pressure on the shaft of approximately 175,000 pounds. Again, I have seen heavy machine tools run with a bearing temperature of 400 deg. F. Recently the Engineer of Tests of a large railroad assured me that the heavy modern locomotives on that road ran with a continuous main driver temperature of over 900 deg. F. with grease lubrication. Yet the bearings gave no trouble over a 186-mile run where speeds of 60 miles per hour were held for long distances.

There seems to be no set temperature at which a bearing can be run without cutting or seizing, up to a temperature of approximately 1,000 deg. F. and yet for the most economical use of power the temperature of the bearing must be held to the lowest possible degree. From past experience, both in design and test of sleeve bearings and anti-friction bearings, I would state that this figure would be from 30 to 50 deg. F. above room temperature.

Both the lubricant and the manner of applying it must be considered in any bearing design. A surplus of lubricant, especially in anti-friction bearings, is worse than not enough. In the case of sleeve bearings, the surplus will generally run out at the ends of the bearings. But even here, unless the reservoir be exceptionally large, the continual working of the oil by an oil ring, or by a pump, will generate such a degree of heat in the oil, that added to the heat of the bearing, will cause the heat of the bearing to rise past the economical figure. In anti-friction bearings, the continual working of the oil supply always retained in the bearing will set up an internal friction in the oil, and may generate an undesirable degree of heat. Anti-friction bearings require but a small amount of lubricant to dissipate the small amount of heat generated.

The Gear Shaper As an Inspection Tool

SAM TRIMBATH

Tooth profiles and cutters may be accurately checked on an idle production machine

WELL known for its ability as a gear cutting machine the No. 6 Fellows gear shaper, shown in Fig. 1, can be used in checking the accuracy of spur and helical gears and also spur and helical cutters. This machine had been replaced by a No. 7 high-speed gear shaper for cutting purposes. It was then converted into a measuring machine at a nominal cost.

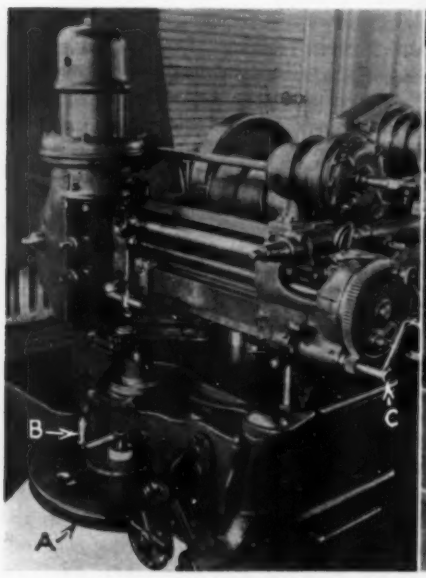
In fact the use of the above machine as an inspection tool will prove a valuable addition to any gear inspection laboratory for the analytical study of gearing. To the gear student its application to inspection problems will be of assistance in his study of the involute curve.

The basis for the adoption of the gear shaper as a precision inspection or measuring device is the accuracy of its worm wheel in the indexing gear train. The large wheel of the train which is located at the lower end of the work spindle at *A*, Fig. 1, has 240 teeth and a diameter of 24 in. which is approximately seven times the size of the helical cutter mounted upon the work spindle as shown at *A*, Fig. 2. The worm that actuates this wheel has but a single thread, and one complete turn of the worm will rotate the cutter through an arc precisely 1 deg. 30 min.

Through the four change gears of the machine at *A*, Fig. 3, practically any desired fractional turn of the worm can be obtained. The disk *B*, Fig. 3, is attached to the shaft that carries the first gear of the change gear train. For the particular cutter shown the disk was made 7 in. in diameter, and 125 equally spaced lines were cut on its periphery, the work being done on a gear cutting machine. The reason for 125 lines will be given later. In this case, each division represented an angular movement of 5 sec. for the large worm wheel, and at the extreme outside diameter of the cutter, the movement is less than 0.00005 in.

To check tooth profiles, an arm *B*, Fig. 2, is mounted on the regular cutter spindle. Upon this arm the lever *C*, one end of which acts as a tracing point, is suitably arranged to actuate the dial indicator *D*. When the point of lever *C* is in contact with the tooth profile, this indicator records any rotative movement of cutter. Another indicator *E* records any movement of the cutter spindle and consequently any radial movement of the lever point.

Fig. 3 — Graduation of a disk on the first change gear shaft makes it possible to rotate the work to close limits without calculation



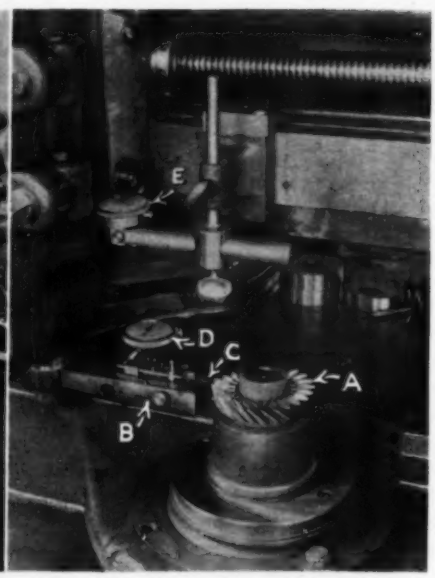


Fig. 1—Use is made of the accurate worm wheel of the gear shaper to secure angular measurements on the cutter. Fig. 2—One indicator records rotation of the work or cutter to be checked while another shows radial movement

To insure radial traverse of the lever point, when setting up the machine for profile inspection, it is checked against a radial master as in Fig. 4. The relative position of the cutter and work spindles is adjusted until no movement of indicator *D*, Fig. 2, is discerned when the cutter spindle is traversed. The graduations of the indicators represent 0.0001 in. and one complete turn of *E* records a traverse of 0.010 in.

The outside diameter of the radial master is made equal to the diameter of the work to be inspected minus 0.020 in. The point of lever is located the required distance from the center of the work through the use of a feeler gage 0.005 in. thick.

The radial master is then replaced by the work to be inspected, as shown in Fig. 2, and the tooth profile is brought into contact with the lever point until indicators *D* and *E* register zero.

With contact taking place at a definite radius *O R*, Fig. 5, a chart is prepared beforehand showing successive reductions of *O R* in steps of 0.010 in. (exactly one turn of the indicator shown at *E*, Fig. 2) and the corresponding angular movements of the work α that will keep the point of the contacting lever on the radial line *O R*.

The actual operation is performed by rotating the work away from the contact lever through the charted arc by means of crank *B* Fig. 1, and then traversing the pointer toward the work center, by means of crank *C*, one turn of the indicator *E*. This brings the pointer in contact with the tooth profile again, and indicator *D* will again read zero, providing the involute profile of the work is correct and has a base diameter equal to the base diameter used in computing the chart. The operation is repeated through the successive steps, and any deviations from the zero reading are recorded upon cross-section paper.

The formula used in computing the chart, Fig. 5, follows:

O R = designated radius from center *O* to the profile

O C and *O C'* = base radius

$$\frac{O\,C}{O\,R} = \cos\,\phi$$

$C\,R = C\,C'$

$\beta = \tan\,\phi - \phi$ in radians

α = reduction of β or the angular movement.

As the profile readings are taken in the plane of rotation, the above formula applies to both spur and helical gears.

For the helical cutter, shown in Fig. 2, the first contact is made at 1.850 in. radius, and the first angular movement corresponding to 0.010 in. traverse movement is 10 min. 25 sec. or 625 sec. As one complete turn of the worm, which actuates the worm wheel, equals 1 deg. 30 min. or 5400 sec., the change gear ratio is $\frac{5400}{625}$. This, broken down into suitable change gears becomes $\frac{108}{40} \times \frac{64}{20} = \frac{\text{driven}}{\text{drivers}}$, and one complete turn of the disk *B*, Fig. 3, rotates the cutter through the first angular movement. Each succeeding movement is then a fractional turn of the disk and becomes less as contact approaches the base circle. For this reason, the disk was graduated into $\frac{625}{5} = 125$ divisions, and each division became 5 sec.

It then becomes a simple matter to count off the required number of divisions for each angular movement and to stamp the position numbers upon the face of the disk. As the angular movement becomes successively less the position numbers follow each other in numerical order relative to a line scribed on pointer *C*, Fig. 3. This avoids the necessity for counting during the operation of checking profiles on this or any future gears or cutters having the same base diameter and outside diameters the same or less than the one for which the chart is computed.

Interpretation of the graphs recorded in Fig. 6 follows:

1 indicates a plus pressure angle, 2 a minus pressure angle, while 3 would be considered an accurate profile as the graph follows the perpendicular or radial master line closely. 4, 5 and 6 represent modified involute cutter profiles that deviate from the master lines toward the tops and base of the teeth. The deviation near the top would tend to "flank out" the gear cut with this cutter, while that toward the base would result in what is commonly known as "tip relief."

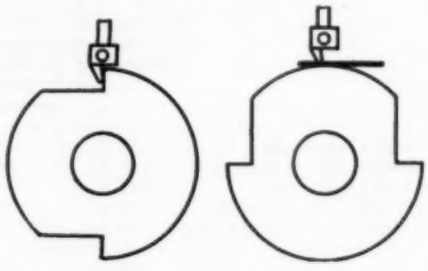
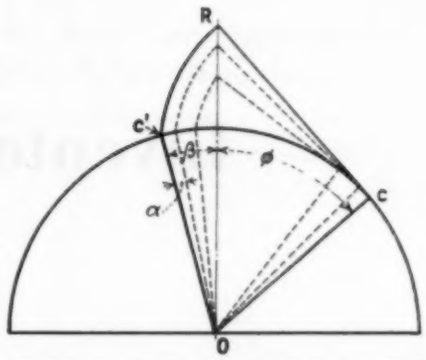


Fig. 4—A master blank is used to insure proper radial readings when setting up the machine



Disk Position	OR	α in Seconds	Disk Divisions
0	1.850	—	—
1	1.840	625	125
2	1.830	615	123
3	1.820	605	121
4	1.810	595	119
5	1.800	580	116
6	1.790	565	113
7	1.780	550	110
8	1.770	535	107
9	1.760	520	104
10	1.750	505	101
11	1.740	490	98
12	1.730	475	95
13	1.720	455	91
14	1.710	435	87
15	1.700	415	83
16	1.690	395	79
17	1.680	375	75
18	1.670	350	70
19	1.660	325	65
20	1.650	295	59
21	1.640	265	53
22	1.630	225	45
23	1.620	170	34
24	1.6109	80	16

Fig. 5—To check the profile, a table is prepared giving radial and angular points for the involute

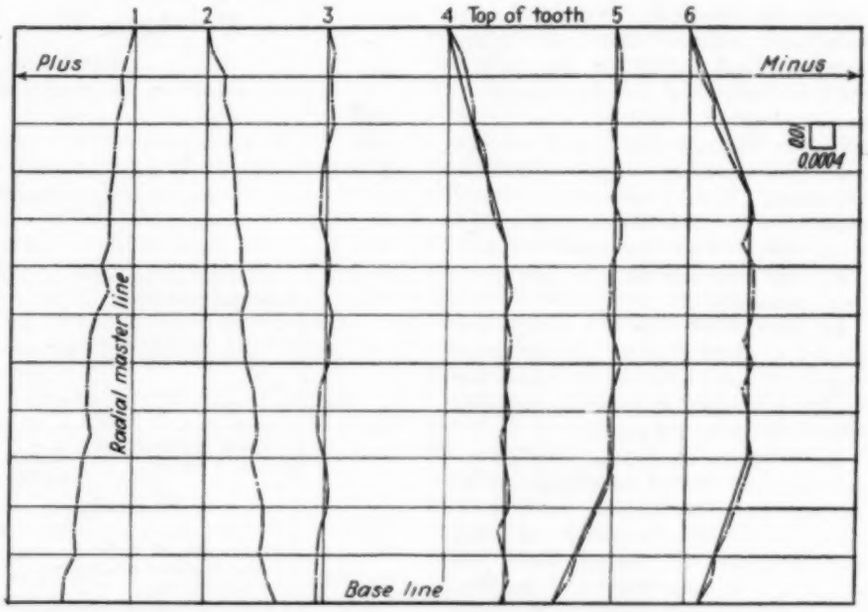


Fig. 6—Readings plotted on cross-section paper show tooth variations

Inventories of Shop Supplies Get Attention

Industrial production is moving up; prices of some things have already done likewise; prices of others are sure to follow. Under these circumstances shop executives are asking themselves:

"Should we build up our shop supply inventory now, against price increases, greater production demand, and delays in delivery?"

To get a practical answer to this question *American Machinist* has discovered what several hundred typical companies have done about it, and what they expect to do in the immediate future. Here are the facts:

SHOP tools and supplies, taken individually, might seem like small matters in the financial life of a metal manufacturing concern. Yet, lumped all together, they constitute a sizable item, both in the inventory, and in the annual purchases. And the strenuous business pressure of the last three years has focussed attention on them sharply, in almost every company.

As manufacturing operations contracted, the buying and stocking of shop tools and supplies underwent many changes. Even the largest manufacturers cut down their standing inventory to a minimum, reduced their order points as far as possible, and cut out order points entirely on some of the less-used items. Smaller companies, in many cases, were forced to eliminate inventory altogether, and to buy tools and supplies only as orders came in that made them necessary.

In short, hand-to-mouth buying was carried to great lengths. In numerous respects it was inefficient, of course, but in many companies business conditions left no choice in the matter.

In the spring the buying situation apparently had started to change, as industrial sentiment became more cheerful. Yet today, hundreds of shop executives are still puzzled about how far to go on shop tools and supplies, so as not to get caught with stocks inadequate to take care of rising production, and at the same time not to let inventories get out of hand. It is a matter of nice balance, between the needs of one's own shop, and the availability of these items in the open market.

In May, several aspects of the situation were explored by *American Machinist* in informal interviews with a number of plant executives. An article entitled, "How Low Inventory?" (*AM*—Vol. 77, page 293) told the story.

Now, *American Machinist* has just completed a second investigation in which it has found out exactly what several hundred representative com-

TABLE 1

How Many Companies Have Increased their Purchases Already? How Many Expect to Do So Shortly?

Per cent of companies reporting (213 total)

	Number of Companies Reporting	Have Already Increased their Purchases		Expect Shortly to Increase Purchases	
		—providing for increased current production	—to build up larger inventory	—anticipating price increase	—anticipating increased production
Large Companies	33.3	17.8	5.1	6.1	17.8
Medium Size Companies	23.5	16.0	0.5	5.1	9.4
Small Companies	23.5	13.6	1.9	5.6	8.9
Very Small Companies	8.9	4.8	1.9	1.9	5.1
Unidentified Companies	10.8	8.0	0.5	2.4	1.9
	100.0	60.2	9.9	21.1	43.1

TABLE 2

On What Tools and Supplies Have *Increased* Purchases Been Made Recently?

(Reports from 140 companies)

	Companies which have increased their purchasing of each item (per cent of companies reporting)	
	—providing for increased current production	—to build up larger inventory
Drills and reamers	56.4	5.0
Taps and dies	49.3	6.4
Standard milling cutters	26.4	3.6
Standard gear cutters	5.7	0.7
Chucks	11.4	0.7
Die heads	15.7	1.4
Chasers	25.7	3.6
Tool and die steel	49.3	6.4
Hack-saw blades	57.9	4.3
Files	45.0	2.9
Gages, measuring tools	12.9	2.9
Wrenches	20.7	0.7
Portable electric tools	6.4	2.1
Welding rod and electrodes	30.0	3.6
Abrasive wheels	57.5	6.4
Lubricants, coolants, quenching oils	52.1	4.3
Belting	41.4	3.6

TABLE 3

On What Tools and Supplies do These Companies *Expect to Increase* their Purchases in the Near Future?

(Reports from 116 companies)

	Companies expecting to increase inventory stock on each item (per cent of companies reporting).	
	—anticipating price increase	—anticipating increased production
Drills and reamers	19.0	45.6
Taps and dies	12.1	44.0
Standard milling cutters	8.6	30.2
Standard gear cutters	2.7	6.9
Chucks	3.4	6.9
Die heads	4.3	6.9
Chasers	5.2	20.7
Tool and die steel	22.4	45.6
Hack-saw blades	17.3	37.0
Files	12.9	33.6
Gages, measuring tools	5.2	9.5
Wrenches	5.2	12.9
Portable electric tools	3.4	9.5
Welding rod and electrodes	6.0	23.3
Abrasive wheels	15.5	45.6
Lubricants, coolants, quench'g oils	8.6	33.6
Belting	10.3	21.5

TABLE 5

On What Specific Tools and Supplies Are Minimum Order Points Being Kept?

(Reports from 104 companies)

	Per Cent of Total Companies reptg.		
	Companies that Keep Order Points		Total
	—on Selected Items	—on All Items	
Drills and reamers	27.9	63.5	91.4
Taps and dies	30.7	63.5	94.2
Standard milling cutters	25.0	63.5	88.5
Standard gear cutters	16.4	63.5	79.9
Chucks	19.2	63.5	82.7
Die heads	16.4	63.5	79.9
Chasers	23.2	63.5	86.7
Tool and die steel	25.0	63.5	88.5
Hack-Saw blades	31.5	63.5	95.0
Files	30.7	63.5	94.2
Gages, measuring tools	17.3	63.5	80.8
Wrenches	19.2	63.5	82.7
Portable electric tools	17.3	63.5	80.8
Welding rod and electrodes	18.3	63.5	81.8
Abrasive wheels	28.4	63.5	91.9
Lubricants, coolants, quenching oils	27.9	63.5	91.4
Belting	23.2	63.5	86.7

TABLE 4

How Many Companies are Now Keeping Minimum Order Points?

(Reports from 129 Companies)

Size Group	Per cent of total companies reporting			
	Number of Companies Reporting	Companies that Keep Order Points		Companies that Keep No Order Points at All. "Buy as We Need"
		On All Items	On Selected Items	
Large Companies	38.0	18.6	18.6	0.8
Medium Size Companies	22.5	13.9	4.6	3.8
Small Companies	17.5	8.5	4.6	4.7
Very Small Companies	11.0	3.8	3.8	3.1
Unidentified Companies	11.0	6.2	3.8	0.8
TOTAL	100.0	51.0	35.4	13.2

panies are doing about it. The information was secured from 226 companies by a detailed questionnaire. These companies constitute a good sampling, being of all sizes, in all parts of the country, and in all branches of the metal-working industry. They spoke frankly, because the investigation was confidential as to names of companies and individuals.

The total number of companies reporting is as follows:

Large companies	80
Medium-size companies	53
Small companies	50
Very small companies	20
Unidentified[1] companies	23
	226

(1) Some companies preferred to remain anonymous.

The facts are reported in this article, with some comments, but for the most part the reader is allowed to see what is happening and draw his own conclusions. The tabulations show how the practices vary in large and small companies[2], wherever a significant variation was found. The companies which supplied this information differ widely on some points, agree significantly on others.

American Machinist wishes here to thank cordially every company which supplied this information about its own operations.

(2) Companies are classified here according to Dun & Bradstreet's financial rating.

Large	Above $500,000
Medium-size	$125,000 to $500,000
Small	$20,000 to $125,000
Very small	Below $20,000

With the expansion of industrial activity since March, it was natural that purchases should jump quickly. The great stocks of tools and supplies left over after the hay-making of 1929 had been gradually used up in nearly every company, and there were only small reservoirs to dip into. Thus it was found that the large majority of those companies that were producing more had increased their purchases on a great many items, or will do so, Table I.

Notice how few companies are buying simply to build up inventory. In most cases, the buying is for immediate production needs. This fact expresses great confidence in the distribution channels through which these tools and supplies are purchased. Were the manufacturer and the supply house not functioning smoothly, a shortage of some items might easily occur if production demand kept increasing sharply.

There are 45 companies intending to purchase various items against expected price increases, compared with 92 who are purchasing purely to meet production demand. That more companies are not stocking up in advance is a little surprising. With the threat of higher prices and inflation spread throughout the land, there has been about as great an inducement to do so as one could imagine. Probably the pressure of conserving cash for current operations only is still very heavy, or else these companies prefer to do their "speculative buying" in other things.

Even some of the companies that have as yet had no increase in production are

TABLE 6

How Many Weeks Will Present Stocks Last? —at Current Rate of Production

Reports for all tools and supplies (from 6½ companies)

Large Companies		Medium-Size Companies		Small Companies		Very Small Companies		Unclassified	
Companies	Weeks	Companies	Weeks	Companies	Weeks	Companies	Weeks	Companies	Weeks
1	26–39	1	52	3	26	1	26	2	52
1	26	1	13	1	13–17	1	13	1	26
1	16	2	9	1	4–26	2	8	1	16–26
2	13	1	4–8	2	8*	1	2	1	6
1	10	1	6	1	6	Comments:		1	4
1	8–12	1	4–6	1	4–6	"hard to estimate"		1	1
1	8½	1	4	3	4	"indefinite"		Comments:	
4	8	Comments:		1	3			"struggled along with lots of worn cutters, files, taps."	
1	2–16	"order as we go"		Comments:					
1	4–12	"indefinite"		"keeps even"					
2	6			"only as needed"					
2	4–8								
3	4								
Comments:									
"varies"									
"shortly ahead"									
"not predictable"									

also planning to increase their purchases. There are 11 companies of this class among the 45 who are buying against price increases, and 23 among the 92 companies which are buying to anticipate greater production.

In Table 2 the recent buying of various items is interestingly compared. The most widely-bought tools and supplies have been (in order of importance):

—abrasive wheels
—hacksaw blades
—drills and reamers
—lubricants, coolants, quenching oils
—tool and die steel
—taps and dies

Table 3 shows that in future weeks the same items will be most widely bought.

Buyers will be interested in the items in which price increases seem to be most generally expected. Tool and die steel heads the list:

—tool and die steel
—drills and reamers
—hacksaw blades
—abrasive wheels

As would be expected, large companies keep minimum order points more than smaller companies. They have the facilities, the personnel to do the clerical work and handling, and the capital to invest. Many of the smaller companies have been forced to the extremes of hand-to-mouth buying by the lack of these things. But also they can afford to wait longer because they have smaller proportionate overhead. A number of them do not attempt to keep any inventory at all, but simply buy the tools when they get an order, trusting that they can get them somewhere without delay.

TABLE 7

Specific Instances of Delayed Deliveries

Per Cent of Companies Reporting

	—from manufacture	—from supply house
Drills and reamers	4.1	3.0
Taps and dies	2.4	2.4
Standard milling cutters	1.8	0.6
Standard gear cutters	...	0.6
Chucks	...	1.2
Die heads	0.6	0.6
Chasers	1.2	1.2
Tool and die steel	4.1	1.8
Hack-saw blades	0.6	3.6
Files	1.2	4.1
Gages, measuring tools	2.4	0.6
Wrenches	...	1.8
Portable electric tools	1.2	0.6
Welding rod and electrodes	1.2	1.2
Abrasive wheels	5.3	3.6
Lubricants, coolants, quenching oil	1.8	0.6
Belting	0.6	...
Total	48	46

Job shops of all kinds buy mostly as their orders require. Tools and supplies left over from working on previous jobs form a basic inventory, of course, and additions are made only as needs arise from new jobs taken on.

Yet, in Table 4, it is worth noting that:

one-half of the companies keep minimum order points on *all* items

one-third of the companies keep them on selected items

only one-eighth of the companies keep no order points at all

Table 5 shows exactly how many companies have order points now on each item. This is a useful indicator to the shop executive of what he must be careful to have on hand.

To be specific, *American Machinist* asked how many weeks the existing stocks of each item would last at current rates of production, so that other companies can have some guide in establishing the best levels at which to keep their own stocks.

In Table 6 are a number of general answers showing the usual policy on all tool and supply items as a class.

Of course the extent to which one can depend on quick delivery determines the amount of stock one must keep on hand.

Apparently both the manufacturer and the supply house are taking good care of their customers. There have naturally been some delays in delivery, but the 169 companies that reported had experienced surprisingly few. Of this number 54 companies had experienced delays on one or more items, and 115 had experienced none at all (57 companies did not answer this question, which probably means that most of them had not noticed serious delays, since the natural tendency would be to report them if they had).

Undoubtedly nearly every company had large stocks on hand in 1929 and 1930, and has drawn on them for several years like the camel living on his hump. It took some time to use them up of course. Many companies went so far as to ransack every bench drawer and locker; they unearthed large quantities of tools, and especially large amounts of tool steel. The very large companies exchanged tools between their various plants. Finally, after these stocks were drawn down, the manufacturer and the distributor have had a delicate job of balancing their own production and inventory with their own need for "liquidity."

Delays experienced have been about even as from manufacturer and from supply house. The items on which delays were reported are shown in Table 7. Here is some hint to the purchaser, on which items he might guard against occasional slow deliveries.

EDITORIALS

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EDITORS

Equipment Purchases and NRA

Commendable progress is being made by the National Recovery Administration in finding answers for the many puzzling questions that have been raised by the Recovery Act. General Johnson's frankness in answering these questions as quickly as he is sure of his answer has undoubtedly had much to do with the gratifying public acceptance of the blanket agreement.

The answer to the company union versus trade union dispute is still to be found even though a temporary truce has been patched up. Child labor has gone and the sweatshop is on the way. Abuse of the "stretch-out" in textile mills is under investigation, but we have yet to hear a definite statement of policy on equipment purchases.

From answers to press conference questions and from decisions and statements at hearings a presumptive policy has been pieced together but it lacks the authority of a clean-cut official statement. An official statement should be issued. It would clear the air for administrators, for equipment buyers and for equipment builders.

If such a statement should discourage purchases of equipment that would add to the capacity of a plant, but encourage the replacement of inefficient obsolete units, it would be in line with the best thought of recent years, and would be acceptable to most of the various interests involved.

Not Industry Alone

Some leaders of industry feel that they have been singled out for criticism and admonition. They believe, and rightly, that others have been at least equally responsible for the past three years. It is the feeling in some quarters in close touch with Washington that they are not likely to be lonesome for long.

Those who have studied the matter closely are confident that Gen. Johnson and his aids know full well that industry itself is only part of the story. But this is their part and the only place in which they could make a start. When industrialists begin to point out that they cannot conform to the new requirements without the cooperation of the bankers, more traditions of banking are likely to be broken, and industry will have plenty of company in being regulated.

An example of banker failure to cooperate came to notice recently. An old concern, under the same careful management that built it up and had carried it through the panics of 1913 and 1920, wanted to borrow for current expenses. Its physical assets, at forced sale, were many times the amount asked. Its business had been increasing satisfactorily for several months and there was every prospect of getting out of the red in the near future. The bank had ample funds available according to their own report, but still refused the modest loan requested.

It is a bank's business to sell credit on good security just as a machine builder sells machines. No one wants to see the type of wildcat loans that played havoc a few years ago. But unless banks function in aiding legitimate industry, industry may be unable to do its part in increasing wages and in hiring more men. When this failure to cooperate slows up the recovery program, bankers can expect to hear from Washington in no uncertain terms.

Whether we like the recovery plan or not there can be no division of opinion as to the necessity for recovery itself. And no group can be permitted to stand in the way.

A Profitable Economy

Word that the work being done by several divisions of the Bureau of Standards is to be taken over by the American Standards Association is news of a profitable economy move on the part of the Administration. Those of us who have been close to the standardization movement in this country well remember the difficulties encountered in trying to reconcile the A.S.A. and the Division of Simplified Practice in Washington. It is to the credit of both groups that a way to cooperate was found.

The placing of this work under a single directing organization should prove to be a real help to those engaged in it. Industry is the principal beneficiary of standards work and should therefore foot the bills and have a voice in its control. As President Coonley of A.S.A. points out, NIRA codes will undoubtedly call for a lot of rapid work in standardization and simplification, qualitative and dimensional. The new set-up will expedite matters appreciably.

A New Load for the Colleges

Who is going to do the research work in pure and applied science that underlies advances in engineering technique and material prosperity, now that the government has followed industry in drastic curtailment of such work? Granted that some of the scientific departments in Washington may have been overstaffed, it is hard to see why we should follow the Russian example in practically wiping them out completely. Millions of dollars' worth of scientific equip-

ment must now stand idle because there is no one to use it.

If the men responsible for this curtailment are looking to industry for scientific research they are going to be disappointed. A few of the very large corporations will go ahead because they have the funds to do so, but on a reduced scale because they need the money for other things. Many people have the idea that some, at least, of the industrial codes now under consideration are going to operate to restrict industrial research.

There is only one answer to the question—the college laboratories will have to take on the load. Many good men are available here but their resources are not large and most of them have teaching schedules to carry. They are our last resort, however, and the load will apparently have to be carried by them.

CHIPS

Washington—NRA drafts prominent men to serve on state and district boards to promote recovery . . . Consumer cards issued to prod merchants slow to sign up under blanket agreement . . . Deadlock in soft coal strike situation forces establishment of mediation board to handle this and similar situations that are likely to follow . . . Lewis demands 6-hour day in coal code . . . Pending completion of their own codes many industries sign modified arrangements of the blanket agreement and get Roosevelt's approval of them . . . President announces that where law permits government contracts will be adjusted to allow for advances in wages and materials . . . Promises call for legislation in January, urges states and municipalities to adopt similar policy . . . Code deadline set for Labor Day . . . President rules that U. S. supplies must be bought from code firms . . . Further bureau mergers in Washington reduce forces and cut expense . . . Farley threatens NRA violators under mail fraud law.

Foreign—Growth of feeling that Roosevelt administration is not going to try inflation until results of NIRA are known causes recovery of dollar in foreign exchange and end of flight of U. S. funds abroad . . . France rescinds higher tariffs on U. S. goods . . . French treasury repays half of £30,000,000 British loan . . . French, British and Italian ambassadors at Berlin warn Hitler to keep his Nazis out of Austria . . . Fascist political group called Blue Shirts appears in South China . . . Japanese discuss plans for world's fair in 1940 . . . Sweden votes funds for public works to help reflation . . . Tokio populace practices air raid defense as army planes stage attacks . . . U. S. warships ordered to Cuba as Machado flees to Bahamas . . . de Cespedes sworn in as president . . . British labor urges reemployment plan with reduced hours like NIRA . . . Balbo hailed on return to Rome.

Finance—R.F.C. chairman advises bankers to cooperate in recovery drive . . . Stock Exchange may move to New Jersey if stock taxes are increased . . . U. S. bonds and notes offered August heavily oversubscribed . . . Railroad net earnings in June nearly five times those of June 1932 . . . Tear gas bombs in Stock Exchange ventilating system stop trading . . . Believed to be practical joke . . . Movements of sterling lead to belief that it has been unhitched from franc.

Industry—Western Union refunds $731,000 of wage reduction effective prior to June 30, date of end of 10 per cent cut of last year . . . E. L. Cord and L. B. Manning acquire control of New York Shipbuilding Co. . . . Strikes multiply as labor agitators push their efforts . . . Ore shipments on Great Lakes heavy . . . Placing of Navy contracts expected to give steady work for 2½ years to 30,000 men in private yards . . . Ford announces return to 40-hour week in his plants . . . Still silent on attitude toward automobile code . . . Lackawanna puts all men on full time . . . July steel production at peak for 37 months . . . General Motors raises office salaries 10 per cent . . . Sales for the second quarter are 30 per cent greater than last year . . . Earnings quadrupled in the first half . . . Waltham Watch raises wages 20 per cent . . . Carboloy Co. boosts hourly employees 15 per cent . . . Coal strike boosts prices in Pittsburgh and threatens steel production . . . Tire companies raise wages . . . July automobile production 204 per cent above July, 1932 . . . Railroads retire 1,800 miles of trackage in the past nine months.

Trade—American Brass, Revere Copper & Brass and Scovill Manufacturing raise prices of copper and brass products ½ cent a pound . . . New list of tool steel extras issued . . . Toledo Scale Co. reports largest volume of sales in single day for last five years . . . Lumber orders largest for two years . . . Chrysler June export sales nearly double those of last year . . . Grain trade exchanges submit code to Administrator Peek of the Agricultural Adjustment Act who warns them to clean house.

Indicators—Electrical energy output increases gain over 1932, reaching 15.6 per cent . . . Steel backlog falls 86,546 tons in July and production drops another point . . . *Business Week* index at 69.2 is slightly lower . . . Government forecast indicates short crops because of dry weather but grain prices drop . . . Carloadings at 613,112 were 4 per cent lower than preceding week but 23.5 per cent above last year.

Labor Issue Paramount in Code Hearings

Washington—Stimulated by the call of the blue eagle, the flood of codes to the nation's capitol has been accelerated. Employers realize that important as the President's Reemployment Agreement may be as a stop-gap, it involves for them the sacrifices of separate industrial codes without the ensuing benefits.

A major battle on the labor question was avoided when Robert F. Lamont, former secretary of commerce and president of the Iron and Steel Institute, calmly withdrew the much publicised "company union" section of the steel code. While this action spiked temporarily the labor guns ready to retaliate in a salvo of speeches and made hurried last minute changes in previously prepared manuscripts necessary, it by no means settled the labor question. Mr. Lamont in voicing his withdrawal reiterated that the steel industry "believes that the employee representative plans now in effect at its plants are desired by its employees, and the members of the industry will do everything in their power to preserve the satisfactory relationship now existing with their employees; and that the section will be omitted for the sole purpose of avoiding the necessity of considering at this hearing any questions that are not fundamental to the code."

Another thorn in the NRA side, the coal strike, was removed when a special mediation board was appointed to patch up differences. Shortly following this news came the announcement that a "distinguished tribunal" consisting of Senator Robert F. Wagner, Walter C. Teagle, Gerard Swope, Louis E. Kirstein, William Green, Dr. Leo Wolman and John L. Lewis to act as a national mediation board for the purpose of moving promptly in incipient troubles to end strikes and lockouts.

Meanwhile the coal hearing, parading the immemorial labor difficulties of the industry, took the center of the stage. Forcibly to the fore is the issue as to whether collective bargaining as provided under NIRA might not be met entirely by the new code authorities, originally set up in the coat and suit code and to be included in all future codes, if a labor representative sits on all of them as he doubtless will. On the other side company unions, particularly in the coal fields, have formed an excellent nucleous for national union proselyting. The A. F. of L. plan for "federal unions" is being watched with care for its bearing on the whole labor problem and particularly on the labor phases of the NRA development. The federal charter plan at the start is to issue charters to plant unions although the logical end is conceivably to form national unions of industrial workers more or less on the line of the United Mine Workers. The first step however, to form shop unions with federal charters is a direct blow at the company union.

Meanwhile NRA reiterates its position that NIRA is not going to be used either to unionize or not to unionize American industry. The battle is being kept out of Washington so far as possible.

Machine Tool Dealer Code Completed

A draft of the tentative NRA code for the Associated Machine Tool Dealers has been completed by the association's committee and mailed to members for their consideration. No date has been set for a hearing on this code.

Dealers in Used Equipment Organize

On August 8, at the Hotel Pennsylvania, New York, a group of eastern used machinery and equipment dealers, met to organize under NRA requirements. Charles Simmonds, of the Simmonds Machine Tool Co., was appointed temporary chairman.

Telegrams from other parts of the country promising cooperation and support were read. It was determined to form a national association to be called National Institute of Used Machinery and Equipment Dealers and to draft a code. Another general meeting is planned for August 17 at the same place.

Metal Products Makers Prepare Code

Washington—The effort to bring the metal fabricating industry other than machinery into a single basic code under NIRA brought a large gathering of the immensely variegated groups of this "industry" to Washington last week. Under the chairmanship of H. O. King, deputy administrator, they went far toward drawing up a document which will be acceptable, at least, to the NRA. The basic principle of agreement has been the similarity of employment conditions, and the point made to NRA officials that unless such a general code were drawn up and approved, certain groups of metal fabricators might obtain an early advantage by having their own smaller codes approved while the mass of the industry was still working without the advantages offered. These advantages, obtainable under NRA in exchange for the provisions designed to increase employment and general purchasing power, are the right to organize, to control trade practices, and probably, in the final interpretation, to control prices.

The code in tentative form was discussed, questions as to the value of a new general association (in which the dues might be as much as $25 a year) in addition to existing associations, were

• INDUSTRIAL REVIEW •

With the exception of a few bright spots, the first half of August showed a slight slackening as compared to July. Manufacturers are inclined to place the blame on NRA activities, particularly the so-called blanket code, rather than on a seasonal slump. Uncertainty as to the administration's policy on new equipment is dampening the enthusiasm for the reemployment drive. However, sentiment for September is more optimistic.

New York is one of the bright spots because of the release of several large orders in the state. Business here is better than at any time since 1931. New England, with July orders at a two-years' peak, feels a slowing up.

Pittsburgh and Cincinnati, too, have experienced a lull but see an increase later in the month because of stiffening prices. Cincinnati finds supply and second-hand machinery sales higher. Foreign business, including orders from Italy, is also better. Cleveland finds inquiries more serious if not more numerous but believes code-watching has delayed their conversion into orders. Small tool sales are better.

A large number of Chicago deals are on the verge of closing, indicating a steady improvement for the Fall. Buyers appear wil'ing to go ahead as soon as the present uncertainty has cleared. Detroit finds business quieter in the last few days and is worried about the 3 per cent Michigan sales tax. In Milwaukee and Indianapolis there has been a marked slowing up. St. Louis reports no change.

disposed of, and the problems of the code formation were assigned to various committees. It conforms, in general, to the codes heretofore drawn up for other broad groups, emphasis being on employment conditions, on the organization of a "code authority" to be the determining factor in the changing picture of the industry, and on unfair trade practices.

The general discussion converged toward minimum wages of 35 cents an hour for men, 30 cents for women, unless they were paid less on July 15, 1929, when the minimum becomes 30 cents for men and 25 cents for women (unless 1929 was higher, when that rate is taken). Hours are set at 40 a week, with a leeway to 48 hours including overtime, and overtime is not to be a total of more than 32 hours in any six months.

It has been brought out, in other hearings, that figures are always drawn up by the statistical division of the NRA regarding 1929 employment, and the industry is asked to accept a week of short enough hours to put as many back to work as were employed in 1929. This is the basis of the bargaining on the side of NRA, however. For instance, in the knitting machinery hearing last week, the NRA hour was about 33 hours, the code as submitted provided for 40, and the compromise will probably be 36, although the code still retains 40.

The question of the integrated industries is yet to be worked out, and the code of the "Finished and Component Metal Products Fabricating Industry" may turn out to be the field where this is finally settled. The discussions of the proposed general code did not solve this difficult problem.

First Machinery Code Heard in Record Time

Twenty-three minutes flat was the record made by Deputy Administrator Malcolm Muir for a public hearing on the knitting, braiding and wire covering machine industries. "No use letting them think they are in Congress," said Deputy Muir at the close of the hearing.

Many of the most vital questions of the machinery and particularly the textile machinery building industry were brought into the open during the hearing. The issue of decreased working and machinery hours, as affecting costs and therefore business and employment; the issue of machine rental; and the issue of the open shop were all brought up. The position of the industry clearly stated that all these matters would be taken under consideration and would be determined in the code as finally submitted to the President for his approval.

Walter L. Toy, vice-president of Scott & Williams, speaking for the joint committee of the Knitting Machine Manufacturers Association and Braiding and Wire Machine Association, made the presentation for the 40-hour week, stating that with this provision there would now be additional employment of 10 per cent, and a substantial increase beyond that should business return to normal. The industry's contention against reducing the hours to 36 were that, although machine builders, their demands for machinery came at time of style changes, required quick deliveries and stock could not be piled up in slack times; that the foreign business, averaging 20 to 50 per cent of production, would be destroyed, in spite of the benefits to export from the lower value of the dollar, if the greater cost of further reduced hours were added; that the volume of the special tools needed for a larger number of workmen was such as to delay and add to the cost of manufacture; that skilled help required 2 to 3 years to train; that heat-treating, vitally important, required generally 8 hours of continual attention; that working weeks of 48 to 56 hours have been the rule of the industry and a greater change would be a hardship. The contention was made that because of the effect on export trade in knitting machinery and to general costs, there would be less rather than more employment if the costs were put up by reducing working hours to 36.

The minimum pay rate was accepted at 40 cents an hour, and Mr. Toy remarked that the percentage of employees in the industry earning less than 40 cents today was "perfectly negligible." In connection with wages, Mr. Muir made the ruling that a definite statement be made in the code as to the differential between unskilled and skilled workers. It was definitely agreed that provisions would be made for the payment of the wages now earned in 48 or 50 hours, for the new 40-hour week, through adjustment of the hourly rate. It was indicated that there will be some net reduction in the pay envelopes of men now working 56 and 58 hours a week; some plants have already made such an adjustment of hours and wages.

The open-shop clause, providing that the acceptance of the "collective bargaining" clause of the NIRA "does not impair the joint right of employer and employee to operate an open shop" and that it did not "prevent the selection, retention and advancement of employees on the basis of their individual merit, without regard to their affiliation or non-affiliation with any labor organization" brought from Deputy Administrator Muir the following ruling:

"Any statement that would in any sense qualify the meaning of Clause 7 (a) of the NIRA, which is mandatory, and part of the law, would be impossible and could not be placed in the code. That, of course, will be taken under advisement by the legal department as well as the Administrator, and they will have to decide whether that clause does qualify the clause, and if so, you realize that it will come out of the code."

An important change, made without objection from the industry, was the increase of the proposed committee of six (three from each association) which is to act as a code authority for future revisions of the code, by three additional members, named by the NRA, one to represent labor, one the consumer and one the NRA. This was suggested by Deputy Muir and accepted by Mr. Toy for the industry. This will set up the same type of Code Authority which has been arranged for in all other codes which have been approved. General Hugh S. Johnson, Administrator for Industrial Recovery, has stated categorically that NRA will approve no code that does not contain this provision.

Oil Burner and Gasoline Pump Makers File Codes

August 21 has been designated by Deputy Administrator R. B. Paddock for a public hearing on the proposed code for oil burner manufacturers. This industry employs 50,850 people and includes 10,200 firms, manufacturers and distributors.

Labor provisions fix working hours at an average of 32 hours per week from January to June, not to exceed 40 hours in any one week. From July to December the average is 40 hours not to exceed 48 hours in one week. Hours for office and salaried workers are limited to 40. The minimum wage is 45 cents an hour with $15 weekly for office employees.

Gasoline pump makers have submitted a code limiting hours to 33 per week with a minimum wage of 40 cents. This industry has been permitted to operate temporarily under the PRA with the hours and wage rates in the proposed code substituted for those stated.

Blanket Agreement

Questions asked and their answers

Broad in scope but brief in verbiage, the President's Reemployment Agreement was sure to uncover conditions not specifically provided for. A shower of questions resulted, some foolish, some justified. They hit Washington in a deluge but many of those pertaining to metal-working plants were aimed at the *American Machinist* editorial office.

Some of the queries most often repeated appear below. From the interpretations given out by the NRA the answers have been compiled by our Washington correspondent. More specialized questions should be directed to Gen. Thomas S. Hammond, executive secretary, President's Reemployment Program.

Q. Is the Presidential Agreement a code or a substitute for a code.

A. No. It comes under an entirely different portion of the NIRA.

Q. How does it differ from a code?

A. The agreement is an agreement between an individual manufacturer and the President of the United States; a code is a "law merchant" prepared by an industry and presented through its trade association, made legal through acceptance of its provisions by the President.

Q. How does it differ from a license?

A. The licensing feature of NIRA, if it is ever invoked, will be a mandatory provision by which no industry in the country, whether or not it has a code or has signed an "agreement," can operate without direct authorization from the President. The agreement is voluntary, personal, has no penalties and no enforcement provisions except public opinion.

Q. What about the provisions of the "code" by which I agree to raise wages of higher paid employees as well as the minimum?

A. It has been ruled that this means that you will not reduce pay of such groups even to compensate you for the cost of raising the minimum wages in your plant, the idea being that you will not merely share work, but endeavor to raise purchasing power. It also means that you shall make fair revisions. For instance, if you reduce your hours from 40 to 35, you should pay the old wage for the reduced time, but if you have men working 60 hours, say, at this time, you should pay for the new 35-hour week as if it were 40 to 48. "Seasonal or temporary increases in hours now in effect, or recent increases in wages, are proper factors to be taken into consideration in making equitable arrangements." Long-standing differentials should rule the decision, and should be maintained. It is recognized, however, that heavy payroll increases are involved, and the employees are expected to cooperate and realize that they, too, "will receive benefits from shorter hours, the reemployment of other workers, and from the stabilized employment which may increase their yearly earnings." When you sign the agreement and also join in a code, the decision at NRA is that your determination of an "equitable adjustment" should be accepted, at least until Sept. 1, and pending the action of NRA on your industry's code.

Q. How do I get a hearing on my petition for change in the provisions of the Agreement on account of "great and unavoidable hardship?"

A. Address a petition to Gen. Hugh S. Johnson, National Recovery Administration, Washington, D. C., setting forth the case. Get your trade association or, if there is none, your local chamber of commerce, to give you a written approval, in support of what you say. This will be accepted as the basis of a temporary stay. The petition must contain a promise to abide by NRA's decision, even if it turns out to be against you. After you have done this, you have complied with the terms of the Agreement, can sign your card and get your emblem from the post office. It is to be noted that exceptions are, for the present, individual, and not by groups or industries.

Q. What can I do under the President's Reemployment Agreement about my contract with a union?

A. The ruling says: "Where an employer is bound by the terms of a contract with a labor organization entered into as the result of a bona fide collective bargaining and he is unable to effect a change in such contract by agreement in order to comply with the terms of the PRA, he may certify his compliance with the PRA with the following exception: "except as required to comply with the terms of agreement in effect between the undersigned and (name of labor organization). It should be understood that his (the employer's) exception can be made only in the case of a contract not subject to change at the discretion of the employer and then only after a certified copy of the contract has been filed with the NRA and its approval has been given to the exceptions stated."

Q. If I do not have a contract with a labor union, how am I to adjust the difficulty arising out of the enforced reduction of hours?

A. The ruling apparently places the employer of non-union labor at the disadvantage suggested in the following ruling, as compared with the employer of union labor under a union contract: "Paragraph 7 of PRA prevents the reduction of compensation in excess of the minimum, whether it is paid by the hour, day, week or month. Therefore, an employee previously paid by the day, week or month will receive as much for the shorter day, week or month. An employee previously paid by the hour will receive as much per hour, but as shortening of his hours will reduce his actual earnings per day or week his compensation per hour is to be increased by an equitable adjustment. There is no fixed rule which can be applied to determine what is an equitable readjustment. In general, it will be equitable to figure what an employee would have earned at his previous rate per hour in a normal week in the industry, and then to increase the hourly rate so as to give him substantially the same compensation as he would have gotten for that normal week. But consideration must be given to factors including: Is the existing rate high or low compared with the average rate paid in the industry? Will the resulting adjustment result in an unfair competitive advantage to other employees or other trade or industries?"

Q. How much power has a trade association or a chamber of commerce to grant relief?

A. None, except that the petition for relief to be sent to NRA has to be certified by a trade or a commercial organization.

Q. Are repair crews, etc., exempted from the labor provisions?

A. No, but they may work in emergencies, and shall be paid time and a third for their overtime.

Q. I find no provision for lower pay for apprentices, such as is arranged in the codes. What of this?

The ruling is that apprentices, if under contract Aug. 1, 1933, do not come under the minimum wage provision, but no one who has already served an ap-

prenticeship may be classified as an apprentice for the purpose of giving him lower pay.

Q. What about part-time workers?

A. The minimum wage for part-time workers should be such that if they worked the full time (40 hours a week for white collar, 35 for artisans) they would receive the prescribed minimum pay.

Q. Is the agreement with the President enforceable as a contract?

A. No. It is entirely voluntary, and public opinion and patronage is the expected police power. If the agreement is violated, the emblem may be taken away and the offender scored by letter and by publication of his offense.

Q. What is the employees' part in the agreements?

A. Bulletin No. 3 of NRA says of this, "The employees' part is to do their best on the job and to cooperate with NRA and employers in peaceful adjustment of differences. More can be done now for workers through the cooperation of 125,000,000 people than can ever be done by discord and dispute."

Q. Does paying a white collar employee $35 a week automatically eliminate him from limitations as to hours?

A. A ruling has been made that it does if he is "acting primarily, although not wholly, in an administrative or executive capacity."

Q. Are charwomen, window cleaners, and other maintenance forces included as white collar workers, who can work 40 hours?

A. The ruling has been made that they are.

NRA, NIRA and PRA

So many variations of abbreviated terms have sprung into use regarding the Recovery Act, that some accounts on the subject give the impression of a strange language. However, since the terms used repeatedly are so lengthy some form of shortening is needed.

In *American Machinist's* articles and editorials, three abbreviations are currently used: NRA, NIRA, and PRA. NRA is the National Recovery Administration, headed by General Johnson, while NIRA is used to designate the empowering legislation, the National Industrial Recovery Act.

PRA signifies the President's Reemployment Agreement, often inaccurately called the "blanket code."

British Foreign Trade Drops

London—Pretty well all along the line figures relating to British overseas trading for the first six months of 1933 show declines as compared with the same period in 1932, and of course, even larger declines when compared with 1931. Imports at £320,368,731 were lower than 1932 by £40,488,875, while exports at £175,289,757 declined by £11,743,579, and exports of imported merchandise at £25,202,658 fell by £4,127,498. Thus the total exports at £200,492,415 exhibited a drop of £15,871,074.

Including both imports and exports, the total overseas trading amounted to rather more than 520¾ million pounds, a fall of about 56 1/3 million pounds on the 1932 figures. More than half the decline in imports is caused by a drop in the value of food and drink brought in. In the class of imports, known as articles wholly or mainly manufactured, the decline, as compared with the previous year, in iron and steel and manufactures thereof amounted to £2,684,186, and in machinery to £1,823,358. The vehicles class, which includes locomotives, ships and aircraft, also declined by £411,207. In exports the bulk of the total decline, namely, £11,743,579, was in articles wholly or mainly manufactured, the drop here accounting for £8,342,260. The value of machinery exported was £13,138,670, a fall of £2,940,065. On the other hand, exports of non-ferrous metals and manufactures thereof increased by £1,464,569. Exported electrical goods and apparatus at £3,183,473 showed an increase of £353,022. The largest drop was in cotton goods which were exported to the value of £30,263,518, the decline here nearly reaching 3 million pounds. Of the total exports of British production, articles wholly or mainly manufactured accounted for £134,639,959.

In machine tools a slight increase is shown in re-exports, the value of which rose from £11,072 in the first six months of 1932 to £14,330 this year. The figures are of course almost insignificant in comparison with imports or exports. The machine tool imports declined from £520,952 to £361,076 in the corresponding period of the current year, while exports at £804,841 this year compare with £1,726,115 in the corresponding period of 1932. The most significant figures are of course those that relate to Russia; here the decline is from £1,423,831 to £491,996. But even the latter exceeds the corresponding value for 1931, which was £419,924.

A continued decline is shown in the demand from other European countries, machine tools being exported to them to the value of £73,636 as compared with £93,752 in 1932 and £139,163 in the first six months of 1931. The demands from South Africa and British India, at £21,755 and £69,989 respectively, also showed further declines. On the other hand, the value of machine tools exported to Australia rose from £4,300 for the first six months of last year to £18,879 for the same period of this year, and other countries took machine tools in the first six months of 1933 to the value of £128,586, as against £101,943 in the corresponding period of 1932.

Owens Heads Weld Testing Bureau

James W. Owens has recently been appointed consulting engineer and director of the National Weld Testing Bureau, new welding division of the Pittsburgh Testing Laboratory. This bureau plans to make weld testing available at reduced cost by standardization and the elimination of duplication.

For the past three years Mr. Owens has been engaged in private consulting practice and as director of engineering of the Welding Engineering and Research Corporation. For four and a half years prior to this he was director of welding at the Newport News Shipyard and Drydock Co. and was instrumental in applying welding to merchant ship construction. Previous to that, he was for eight years in charge of welding research and development for the

Bureau of Construction and Repair of the U. S. Navy at the Norfolk Navy Yard. In this capacity he wrote the specifications for the first application of welding to cruisers. During the World War, he was a member of the Emergency Fleet Welding Committee.

Active in the work of technical societies, Mr. Owens was one of the organizers of the American Welding Society, its vice-president from 1920 to 1922 and is now a director. He is a member of many other societies and does a great amount of work on technical committees.

In 1929 he was recipient of the Miller Memorial Medal of the A.W.S. and in 1928 received the first prize of $10,000 in the Lincoln Company's international competition sponsored by the A.S.M.E.

Ship Contracts Placed by Navy

Contracts for the construction of 21 ships were recently awarded to private yards as a result of naval building program financed from the emergency public works funds. It is estimated that work will thus be provided for an average of 30,000 men for two and a half years. Thousands more will obtain employment on the additional sixteen vessels to be built in government navy yards.

Successful bidders will conform to the new shipbuilding code which limits the working week to 32 hours. Technical staffs and many workmen have already been hired. Work is expected to be well underway by the end of the year. Of the $130,000,000 involved in the private contracts about $105,000,000 will go to labor. Meanwhile steel and lumber mills, manufacturers of electric supplies, paint, glass, plumbing fixtures and the many other items that go into a modern war vessel, will start work.

According to the Navy Department's announcement contracts have been awarded the following firms:

Newport News Shipbuilding and Drydock Co., two aircraft carriers.

Bethlehem Shipbuilding Corporation, one heavy cruiser and four 1,850-ton destroyers.

New York Shipbuilding Co., two light cruisers and four 1,850-ton destroyers.

Electric Boat Co., two submarines.

Bath Iron Works Corporation, two 1,500-ton destroyers.

Federal Shipbuilding & Drydock Co., two 1,500-ton destroyers.

United Dry Docks, Inc., two 1,500-ton destroyers.

Allocations of vessels to government yards is as follows:

Two submarines to Portsmouth, N. H.

One light cruiser and one gunboat to Brooklyn, N. Y.

One light cruiser and two destroyers to Philadelphia.

Two destroyers to Puget Sound, Wash.

One gunboat to Charleston, S. C.

Two destroyers to Mare Island, Calif.

Two destroyers to Norfolk, Va.

Recovery Program is Chief Topic at Silver Bay

Economic recovery in its many ramifications will be discussed at the Sixteenth Annual Conference on Industrial Relations to be held under the auspices of the National Council of Y.M.C.A.'s at Silver Bay, Lake George, August 23 to 26. Glenn Gardiner, of the Fortsman Woolen Co., will act as chairman.

Among the addresses to be presented during the 4-day program are the following:

"Industrial Relations in the Light of Present Social and Economic Trends," by Seth W. Candee, Tide Water Oil Co.

"The Aims and Provisions of the Industrial Recovery Act," by Henry H. Heimann, representing Secretary Roper of the Department of Commerce.

"The Significance for Industry of a Partnership with Government," by Howard E. Coffin, chairman, Southeastern Cottons, Inc.

"Transportation Problems," conference led by H. A. Enochs, Pennsylvania R.R.

"Unemployment Relief—Federal, State Municipal—What are the Trends?" conference leader to be announced.

"Rehabilitation of the Unemployed," conference led by J. H. Bentley, director, Adjustment Service Bureau, N. Y.

"The Machine and Its Effects on Human Welfare." Economic effects by Hudson B. Hastings, Professor of Industrial Engineering, Yale University. Social effects by John Carmody, president, National Society of Industrial Engineers.

"A practical Program for Employee Security" by Roderick Olzendam, research director, Metropolitan Life Insurance Co.

"The Economic Background of the Administration's Program for Industrial Recovery," by Henry I. Harriman, president, Chamber of Commerce of the U. S.

"Labor Looks at the Recovery Act," by Sidney W. Wilcox, representing U. S. Department of Labor.

"The Social Significance of the National Industrial Recovery Act," by Spencer Miller, secretary, Workers Education Bureau, N. Y.

Machine Tool Index Jumps

Preliminary figures of the National Machine Tool Builders' Association show an index of gross orders for July of 54.7 compared to 39.8 for June. This advance of over 37 per cent represents the fourth consecutive month of upward trend. July's volume is over four times that of the low point reached in March and is considerably higher than the 1932 average of 35.4.

Shipments at 37.0 are also up from 30.9 while unfilled orders at 58.5 compare with 40.3 for June.

Metal Exhibit to Be Largest Since 1929

Judging from space already reserved for the Fifteenth Annual National Metal Exposition to be held in Detroit, the week of October 2, in connection with the National Metal Congress, this year's showing will exceed any since 1929. More than 100 concerns have reserved 75 per cent of the available space according to W. H. Eisenman, secretary.

Technical papers to be presented by members of the A.S.S.T., American Welding Society, American Institute of Mining and Metallurgical Engineers, the Wire Association, and other participating societies will match the high standard to be set by the exhibitors.

Auto Output Tripled

Production of motor vehicles reported by members of the National Automobile Chamber of Commerce for July was 178,506 as against 58,771 for the same month in 1932. This represents a rise of 204 per cent. Output for June, 1933, was 200,065 units.

A 35 per cent gain in production over 1932 for the first seven months of the year was made by members of the chamber. Units completed in this period totaled 983,683 against 738,989 for seven months last year and 977,134 for the full year of 1932.

Stevens Conference Discusses Finance

The financial situation is the general theme of the third annual Economic Conference for Engineers now being held at the Stevens Engineering Camp, Johnsonburg, N. J. President Harvey N. Davis and Professor William D. Ennis of Stevens Institute of Technology are chairmen of the sessions which commenced on August 12 and will extend to August 20.

Discussion leaders and topics presented are:

"Capital and Confidence," Sherwin C. Badger, Associate Editor of *Barron's*.

"Public Construction and Public Finance," Col. Willard T. Chevalier, *Engineering News-Record*.

"Present-Day Problems of Taxation. Sales Taxes: For and Against," Professor Alzada Comstock, Mount Holyoke College.

"Constitution vs. Parliamentary Government," James H. R. Cromwell, author and economist.

"European Currencies Since the Beginning of the World War," Professor Frank W. Fetter, Princeton University.

"The International Financial Situation," Fred I. Kent, Federal Reserve foreign exchange adviser.

"Future Supply of Capital for Commerce and Industry," Dr. H. S. Person, managing director of the Taylor Society.

"The Fundamentals of Our Industrial Economy," Prof. Walter Rautenstrauch, Columbia University.

"Economic Functions of the Income Tax," Charles A. Roberts.

"Prosperity Pensions," John Willard Roberts.

"Buccaneer Finance: The Plight of the Investor," A. Vere Shaw, Investment Counsel.

"A Newspaper Man Looks at Economics," Earl Sparling, *New York World-Telegram*.

• BUSINESS ITEMS •

The National Acme Co., Cleveland, Ohio, has appointed F. W. ALTORFER as Eastern District sales manager with headquarters in New York City, replacing WILLARD A. JOHNSON, who has gone back to Cleveland to handle special sales assignments.

The Yale & Towne Mfg. Co., Chrysler Bldg., 405 Lexington Ave., New York, N. Y., has purchased the real estate, machinery, tools, inventory, patents and goodwill of the Walker Vehicle Co. and the Automatic Transportation Co., Chicago, makers of industrial electric trucks and commercial electric street vehicles. The purchaser will continue the manufacture and sale of the complete line of each company at 101 W. 87th St., Chicago, under the direction of F. H. TINSLEY.

After August 17, the Bridgeport Safety Emery Wheel Co., Bridgeport, Conn., will be represented in the Pittsburgh territory by THOMAS M. REES, 18 Fancourt St., for the sale of its line of grinding machinery. Mr. Rees was formerly with Motch & Merryweather and later with Manning, Maxwell & Moore, Inc., and the Arch Machinery Co.

The Sibley Machine & Foundry Corp., South Bend., Ind., has been incorporated to engage in the general foundry and machine shop business. Capitalization, $100,000. Incorporators, BERNARD J. VOLL and A. G. GRAHAM.

• PERSONALS •

DEWEY S. BLAKESLEE, president of the Blakeslee Drop Forge Co., and EDWARD G. HACKBARTH, assistant to Mr. Blakeslee, have been elected directors of the Peck, Stow & Wilcox Co., Southington, Conn. They succeed OTTO J. BLANK, Plantsville, Conn., and WILLIAM H. MARLATT, Cleveland, Ohio.

DONALD F. CARPENTER has been named director of manufacturing of the Remington Arms Co., Bridgeport, Conn. The position is a newly created one, and Mr. Carpenter assumed it on July 24.

GEORGE E. JOHNSON resigned from Fairbanks-Morse Co. on July 31 to go with the A. O. Smith Corp., Milwaukee, Wis., as assistant to W. C. HEATH, vice-president and general manufacturing manager.

JOSEPH A. PIACITELLI, consulting industrial engineer specializing on production methods, motion study applications and financial incentives, has changed his address to 7 E. 42nd St., New York, N. Y.

• OBITUARIES •

LEON IRVING THOMAS, vice-president and secretary of the Gage Publishing Co., New York, N. Y., and editor of *Electrical Manufacturing*, died July 30 at the age of 49. In 1907, Mr. Thomas began his career as personal laboratory assistant to Dr. Lee DeForest and later was connected with the American Telephone & Telegraph Co. in an engineering capacity. He entered editorial work in 1912 with the A. W. Shaw Co., and attained the editorship of *Factory*. In 1929 he became managing editor of *Electrical Manufacturing*, and in 1931 he became editor.

ALFRED C. SAYRE, master mechanic of the Dodge plants of the Chrysler Corp., died July 30 at the age of 49. After learning his trade in England, he emigrated to America and served as tool and die maker and later as foreman of the machine repair department of the Buick Motor Co. From 1915 until the time of his death, Mr. Sayre had been connected with Dodge.

GEORGE H. BURKE, 63, founder and president of the Burke Machine Tool Co., Conneaut, Ohio, died Aug. 4 after a long illness.

ADOLPH N. MILLER, president of A. N. Miller Co., Milwaukee, Wis., manufacturer of special machinery and tools, died July 30 at the age of 70. Mr. Miller perfected in 1907 what is said to be the first successful gasoline locomotive.

ARTHUR L. MOORE, organizer of the Moore Drop Forging Co., Huntington, Mass., previously the Springfield Drop Forging Co., died July 23 at the age of 79.

JOSEPH D. OLIVER, chairman of the board of the Oliver Farm Equipment Co., died in South Bend, Ind., on Aug. 6.

• MEETINGS •

NATIONAL ASSOCIATION OF FOREMEN. Annual convention. September 15-16. Akron, Ohio. E. H. TINGLEY, secretary, Refinery Bldg., Dayton, Ohio.

NATIONAL SAFETY COUNCIL. Twenty-second annual safety congress and exposition. October 2-6. Stevens Hotel, Chicago. National Safety Council, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

NATIONAL METAL CONGRESS AND EXPOSITION. October 2-6. Detroit, Mich. Under the auspices of the American Society for Steel Treating. W. H. EISENMAN, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SILVER BAY INDUSTRIAL CONFERENCE. Sixteenth annual conference on industrial relations. August 23-26. Silver Bay on Lake George, N. Y. E. C. WORMAN, secretary, 347 Madison Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. International automotive engineering congress. August 28-September 4. Palmer House, Chicago. JOHN A. C. WARNER, general manager and secretary, 29 West 39th St., New York, N. Y.

American Machinist
REFERENCE BOOK SHEET

Gear Materials and Blanks

American Recommended Practice

Approved July 31, 1933 by the American Standards Association

Forged and Rolled Carbon Steel

1. MATERIAL COVERED. This specification covers steel for gears in three groups, according to heat treatment, as follows—*(a)* case hardened gears, *(b)* unhardened gears, not heat treated after machining, and *(c)* hardened and tempered gears.

2. BASIS OF PURCHASE. Forged or rolled gear steels shall be purchased on the basis of the requirements as to chemical composition specified in Table 1. Class N steel will normally be ordered in ten point carbon ranges within these limits. Requirements as to physical properties have been omitted, but when they are called for the requirements as to carbon shall be omitted.

3. PROCESS. The steels may be made by either or both the open hearth and electric furnace processes.

4. DISCARD. A sufficient discard shall be made from each ingot to secure freedom from injurious piping and undue segregation.

5. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of the elements specified. This analysis shall be made from drillings taken at least one-eighth inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified.

6. Analysis may be made by the purchaser from one or more bars or forgings representing each melt. The chemical composition thus determined shall conform to the requirements specified in Table 1. Drillings for analysis shall be taken at any point not closer to the center than midway between the centre and the surface, but not within one-eighth inch of the surface of the bar or forging.

7. The material shall be free from injurious defects and shall have a workmanlike finish. Cold-finished bars shall have a bright, smooth surface.

8. *(a)* The melt number shall be legibly stamped on each bar or forging 4 inches or over in thickness, and on those of smaller section when so specified. *(b)* The identification marks specified on the order to be stamped on gear blanks shall be placed on the web or in such a position that they will not be obliterated in machining.

9. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications.

10. *(a)* Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported within ten working days from the receipt of samples. *(b)* Material which shows injurious defects while being finished by the purchaser will be rejected, and the manufacturer shall be notified.

11. Samples tested in accordance with this specification which represent rejected material, shall be preserved for two weeks from date of test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Table 1—Chemical Composition of Forged and Rolled Carbon Steel

Use	Class	Carbon	Manganese	Phosphorus	Sulphur
Casehardened	C	0.15 to 0.25	0.40 to 0.70	max. 0.045	max. 0.055
Untreated	N	0.25 to 0.50	0.50 to 0.80	max. 0.045	max. 0.055
Hardened (or untreated)	H	0.40 to 0.50	0.40 to 0.70	max. 0.045	max. 0.055

Forged and Rolled Alloy Steel

1. MATERIAL COVERED. This specification covers alloy steel for gears, in two classes according to heat treatment, as follows: *(a)* case hardened gears, and *(b)* hardened and tempered gears.

2. BASIS OF PURCHASE. Forged and rolled alloy gear steels shall be purchased on the basis of the requirements as to chemical composition specified in Table 2. Requirements as to physical properties have been omitted.

6. Analyses may be made by the purchaser from one or more bars or forgings representing each melt. The chemical composition thus determined shall conform to the requirements specified above. Drillings for analysis may be taken at any point midway between the center and the surface of solid forgings or bars, or cuttings may be taken off the entire end surface; when sampling, the surface material for a depth of at least one-eighth inch shall be discarded.

Note: Paragraphs 3, 4, 5, 7, 8, 9, 10 and 11 are identical with those of the specifications for forged and rolled carbon steel.

Table 2—Chemical Composition of Forged and Rolled Alloy Steel

No.	Carbon	Manganese	Phos. Max.	Sulph. Max.	Nickel	Chrome	Vanadium Min.	Vanadium Desired	Molybdenum
2315	0.10–0.20	0.30–0.60	0.04	0.05	3.25–3.75	.....	..	..	.....
2350	0.45–0.55	0.50–0.80	0.04	0.05	3.25–3.75	.....	..	..	.....
2512	0.17 max.	0.30–0.60	0.04	0.05	4.75–5.25	.....	..	..	.....
3115	0.10–0.20	0.30–0.60	0.04	0.05	1.00–1.50	0.45–0.75	..	..	.....
3215	0.10–0.20	0.30–0.60	0.04	0.045	1.50–2.00	0.90–1.25	..	..	.....
3250	0.45–0.55	0.30–0.60	0.04	0.045	1.50–2.00	0.90–1.25	..	..	.....
3312	0.17 max.	0.30–0.60	0.04	0.045	3.25–3.75	1.25–1.75	..	..	.....
3340	0.35–0.45	0.30–0.60	0.04	0.045	3.25–3.75	1.25–1.75	..	..	.....
6120	0.15–0.25	0.30–0.60	0.04	0.045	.....	0.80–1.10	0.15	0.18	.....
6150	0.45–0.55	0.50–0.80	0.04	0.045	.....	0.80–1.10	0.15	0.18	.....
4615	0.10–0.20	0.30–0.60	0.04	0.050	1.50–2.00	.....	..	..	0.20–0.30

Steel Castings

1. It is recommended that steel castings for cut gears be purchased on the basis of chemical analysis, that only two types of analysis be used, one for case hardened gears and the other for both untreated gears and those which are to be hardened and tempered.

2. PROCESS. The steel is to be made by the open hearth, crucible or electric furnace processes. The converter process is not recognized.

3. DISCARD. Sufficient risers shall be provided to secure soundness and freedom from undue segregation. Risers shall not be broken off the unannealed castings by force. Where risers are cut off with a torch the cut shall be at least one-half inch above the surface of the castings, and the remaining metal removed by chipping, grinding, or other non-injurious method.

4. Steel for use in gears shall conform to the requirements, as to chemical composition as indicated in Table 3.

5. All steel castings for gears must be thoroughly normalized or annealed, using such temperature and time as will entirely elliminate the characteristic structure of unannealed castings.

6. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of the elements specified. This analysis shall be made from drillings taken at least one-eighth inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified.

7. Analyses may be made by the pur-

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American Recommended Practice

Table 3—Chemical Composition of Steel Castings

Use	Class	Carbon	Manganese;	Phosphorus Acid	Phosphorus Basic	Sulphur
Casehardening	C	0.15—0.25	0.40—0.60	0.06 max.	0.05 max.	0.06 max
Untreated or Hardened	H	0.30—0.40	0.40—0.60	0.06 max.	0.05 max.	0.06 max.

chaser from one or more castings representing each melt. The chemical composition thus determined shall conform to the requirements specified above. Drillings for analysis shall be taken at any point not closer to the centre than midway between the centre and the surface, but not within one-eighth inch of the surface of the casting.

8. *(a)* The castings shall conform substantially to the shapes and sizes indicated by the patterns or drawings submitted by the purchaser. When dimensioned drawings are provided, the foundry shall take all responsibility for correctness as to shrinkage.

(b) The castings shall be free from injurious defects and have a workmanlike finish. Defects which do not impair the strength of the castings may be welded by an approved process in a manner satisfactory to the purchaser. The metallic electrode method of electric welding is an approved process. No welding shall be done in a manner to conceal defects. The defects shall be cleaned out to solid metal before welding, and when so required by the inspector, shall be submitted to him in this condition for his approval. All steel castings welded by the foundry shall be heat treated before delivery.

9. The melt number and foundry symbol shall be legibly stamped or cast on each casting six inches or over in thickness or diameter and on castings of smaller section when so specified.

10. *(a)* The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the castings ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications.

(b) If in the case of important castings for special purposes, surface inspection in the green state is required, this shall be so specified in the order.

(c) All tests (except check examination for analysis and annealing) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

11. Castings which show injurious defects or fail to pass check examinations as to chemistry or heat treatment subsequent to their acceptance at the manufacturer's works will be rejected and the manufacturer shall be notified.

12. Samples tested by the purchaser, which represent rejected castings, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests the manufacturer may make claim for a rehearing within that time.

Bronze and Brass Castings

1. MATERIAL COVERED. These specifications cover non-ferrous metals for spur, bevel and worm gears, bushings and flanges for composition gears.

2. BASIS OF PURCHASE. This material shall be purchased on the basis of chemical composition.

3. PROCESS. The alloys may be made by any approved method.

Use and Chemical Composition

4. *(a)* For Spur and Bevel Gears, hard cast bronze, A.S.T.M. B-10-18, S.A.E. No. 62, and the well known 88-10-2 mixture to the following limits:

Copper	86-89%
Tin	9-11%
Zinc	1- 3%
Lead (Max.)	.20%
Iron (Max.)	.06%

Good castings made from this bronze should give the following minimum physical characteristics:

Ultimate strength	30,000 lbs. per sq. in.
Yield point	15,000 lbs. per sq.in.
Elongation in 2 ins.	14%

(b) For Bronze Worm Gears, two alternative analyses of phosphor bronze are recommended, S.A.E. 65 and 63.

S.A.E. No. 65, phosphor gear bronze.

Copper	88-90%
Tin	10-12%
Phosphorus	.1- .3%
Lead, Zinc and impurities (Max.)	.5%

Good castings made of this alloy should give the following minimum physical characteristics:

Ultimate strength	35,000 lbs. per sq.in.
Yield point	20,000 lbs. per sq.in.
Elongation in 2 ins.	10%

S.A.E. No. 63, called leaded gun metal.

Copper	86-89%
Tin	9-11%
Lead	1-2.5%
Phosphorus (Max.)	.25%
Zinc and impurities (Max.)	.50%

Good castings made of this alloy should give the following minimum physical characteristics:

Ultimate strength	30,000 lbs. per sq.in.
Yield point	12,000 lbs. per sq.in.
Elongation in 2 ins.	10%

These alloys, especially No. 65, are adapted to chilling for hardness and refinement of grain. No. 65 is to be preferred for use with worms of great hardness and fine accuracy. No. 63 is to be preferred for use with unhardened worms.

(c) For Bronze Bushings for Gears, S.A.E. No. 64 is recommended, of the following analysis:

Copper	78.5-81.5%
Tin	9 -11. %
Lead	9 -11 %
Phosphorus	.05-.25%
Zinc (Max.)	.75%
Other impurities (Max.)	.25%

Good castings of this alloy should give the following minimum physical characteristics:

Ultimate strength	25,000 lbs. per sq.in.
Yield point	12,000 lbs. per sq.in.
Elongation in 2 ins.	8%

(d) For Brass Flanges for Composition Pinions, A.S.T.M.B-30-32T, and S.A.E. No. 40 is recommended. This is a good cast red brass, of sufficient strength and hardness to take its share of load and wear under conditions of style No. 2 of the A.G.M.A. standards for Composition gearing, a design in which the flanges mesh with the mating gear, and therefore ample for style No. 1. The composition is as follows:

Copper	83 -86 %
Tin	4.5- 5.5 %
Lead	4.5- 5.5 %
Zinc.	4.5- 5.5 %
Iron (Max.)	0.35%
Antimony (Max.)	0.25%
Aluminum	None

Good castings made from this alloy should give the following minimum physical characteristics:

Ultimate strength	27,000 lbs. per sq.in.
Yield point	12,000 lbs. per sq.in.
Elongation in 2 ins.	16%

5. An analysis of each melt shall be made by the manufacturer. The chemical composition thus determined shall be reported to the purchaser or his representative and shall conform to the above specifications.

6. *(a)* The sample for chemical analysis may be taken either by sawing, drilling, or milling the casting, or test coupon, and shall represent the average cross section of the piece.

(b) The saw, drill, cutter or other tool used shall be thoroughly cleaned. No lubricant shall be used in the operation, and the saw dust or metal chips shall be carefully treated with a magnet to remove any particles of iron.

7. *(a)* Inspection may be made at the manufacturer's works where castings are made, or at the point at which they are received, at the option of the purchaser.

(b) If the purchaser elects to have inspection made at the manufacturer's works, the inspector representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

8. Castings which show injurious defects revealed by machining operations subsequent to acceptance may be rejected, and, if rejected, shall be replaced by the manufacturer free of cost to the purchaser. The full weight of the original material rejected shall be returned to the manufacturer.

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• NEW BOOKS •

BUSINESS UNDER THE RECOVERY ACT. *By Lawrence Valenstein, president, Grey Advertising Service, Inc., and E. B. Weiss. 314 pages, 5x7½ inches. Bound in cloth boards. Published by Whittlesey House, McGraw-Hill Book Company, Inc., New York. Price $2.50.*

The first few chapters of this book recount the steps leading up to the passage of the Recovery Act, as business struggled with rugged individualism and *laissez-faire* economics until the catastrophe of March, 1933. A chapter is devoted to the failures of the Federal Trade Commission as having prepared the way for the present law. Another chapter tells of the German cartels because of the experience they offer for the American counterparts likely to spring up under the NIRA.

Since the book is devoted largely to retail merchandising and advertising problems it is of more or less academic interest to equipment builders, but the chapter outlining industry's forty methods of unfair competition is illuminating. The NIRA and the various bulletions and messages connected with it are published in appendixes together with several sample codes.

LABOR RELATIONS UNDER THE RECOVERY ACT. *By Ordway Tead, Lecturer in Personnel Administration, Columbia University, and Henry C. Metcalf, Director of Bureau of Personnel Administration, New York University. 259 pages, 5x7½ inches. Bound in cloth boards. Published by Whittlesey House, McGraw-Hill Book Company, Inc., New York. Price $2.*

As the authors say quite frankly in their introduction this small volume is based on material from which the third revision of a larger text has just been completed. They feel that the Recovery Act will concentrate attention on labor relations and collective bargaining, and they therefore offer for the guidance of those involved the experience that has been gained in recent years.

They state the case for employee representation, explain how it can be set up according to the various plans that have been successful, point out the limitations of each plan, and then go into collective bargaining and industrial councils. Title 1 of the Act and Bulletin 2 of the NRA are included as appendixes.

THE NATIONAL INDUSTRIAL RECOVERY ACT, AN ANALYSIS. *By Benjamin S. Kirsh and Harold Roland Shapiro. 156 pages,5x7¼ in. Bound in cloth boards. Published by Central Book Company, New York. Price $2.50.*

Since both of the authors are members of the New York bar, this volume is essentially a lawyer's analysis of the Recovery Act. It is a quick job, and shows it in spots where the editing has been a bit casual. The explanation of the act given in the second of the five chapters is noteworthy for its skeleton outline of the act which is useful for reference. The basis of the treatment is a record of the difficulties encountered under the anti-trust laws which led up to the passage of the current law, an explanation of the terms of the law, and observations on its importance to the trade association and to labor.

ENCYCLOPEDIA OF SPECIFICATIONS. *Vol. 3, "Standards and Specifications for Metals and Metal Products." Compiled by the Bureau of Standards, U. S. Department of Commerce. Ten chapters, 1359 pages, 7⅝ x 10⅝ in. Bound in green buckram. For sale by the Superintendent of Documents, Washington, D. C. Price, $3.00.*

Any one having need in his work for specifications of metals and metal products should be interested in this third volume of the Encyclopedia of Specifications, which has been under compilation by the Bureau of Standards for several years. Instead of descriptive titles, the encyclopedia reproduces actual copies or gives in suitable abstract form the standards and specifications relating to ores, metals and manufactures (except machinery, vehicles, and electrical supplies), formulated by the national technical societies, trade associations or other organizations in a position to speak for industry or with the authority of the Federal Government. Included are all commodities embraced in the numerical classification designation 600-699 in the National Directory of Commodity Specifications.

Vol. 3 of the encyclopedia includes the following matter: (a) Over 1600 nationally recognized standards and specifications; (b) methods of testing, chemical analyses, metallic coatings, and heat-treatment of metals in considerable detail; (c) 1100 illustrations; (d) 2,000 cross-references to demonstrate the close relationship existing among the specifications assigned to the metals; (e) 1700 tables; (f) an extended index of approximately 3500 items containing all references to any metallic commodity referred to in these 1600 specifications, so that comparisons may be readily made between the specification requirements of the various specification-producing organizations, and (g) a list of technical societies, trade associations, and other organizations issuing standards and specifications for metals and metal products.

INDUSTRIAL MANAGEMENT IN THIS MACHINE AGE. *By Francis A. Westbrook. 406 pages, 5¾x8⅝ in. Indexed and illustrated. Bound in clothboard. Published by Thomas Y. Crowell Co., 393 Fourth Ave., New York, N. Y. Price $3.50.*

Management in its broadest sense is covered in this volume. In addition to manufacturing control, the author includes such allied functions as sales, purchasing and employee relations.

The style is popular rather than technical, and specific examples are freely employed to emphasize the principles described. Weight is given to the effects of management as well as the technique itself by keeping constantly before the reader the results of doing things the wrong way. This approach has the advantage of stimulating the reader to independent analysis.

The ground covered is familiar to students of industrial management. However, Mr. Westbrook places particular stress on those factors likely to influence manufacture during the next decade.

STRUCTURAL MECHANICS. *By Harrison W. Hayward, late Professor of Materials Engineering, Addison F. Holmes, Associate Professor of Applied Mechanics, and Ralph G. Adams, Assistant Professor of Testing Materials, all of the Massachusetts Institute of Technology. 181 pages, 5¾x9 in. Indexed and illustrated. Bound in clothboard. Published by McGraw-Hill Book Company, 330 West 42nd Street, New York, N. Y. Price $2.25.*

Prepared to meet the needs of the students of the Free Evening School established by the Trustees of the Lowell Institute, this volume is a complete revision of a similar text written by Professor Hayward. It is divided into two parts: Force Systems and Mechanics of Materials.

A distinguishing feature of the text is its conciseness. The presentation presupposes familiarity with calculus which is freely employed.

Purchasing Machine Tools for the Small Shop

J. R. WEAVER

Works Equipment Engineer
Westinghouse Electric & Manufacturing Company

Some suggestions for applying large shop methods to small shop conditions

EQUIPMENT purchasing methods used by large manufacturers may not in all cases be applicable to the small shop, but let's just review the situation to see if, by adopting some of these methods, decided improvements cannot be made. In general the small shop is started with very little cash and gradually built up through the efforts of owner or owners. Now equipment plays a very important part in any manufacturing industry. A shop having equipment that will produce most efficiently will be able to meet competition, and at the same time undoubtedly will be able to build up a reserve which is such a desirable thing to have in times like the present.

In order to keep equipment at its highest efficiency, it is necessary from time to time to replace the obsolete units with new ones. All modern industrial plants make such a provision for new equipment by charging a certain amount of the cost of equipment into the cost of their product. This is called "depreciation." This depreciation fund is accumulated and used to the best advantage over the plant. It is possible then to budget the expenditures for new equipment improvements in line with the amount of depreciation that is charged into the product.

Undoubtedly the present is the most desirable time for those who do not have a definite policy along these lines to make necessary changes. Business has passed the bottom and from now on we can expect better things. Therefore, since the small shops play such an important part in industry, they should organize themselves for future business requirements. Competition will be keen and undoubtedly many small shop owners will face the necessity for re-equipping. Some of them, at least, will have sufficient funds because they have provided for such conditions.

We find that small shops employ the best all-around mechanics. This is necessary because usually small shops are more or less jobbing shops, and the mechanics must be trained to do a variety of jobs with equal efficiency. Would it not be desirable to give these high-class mechanics the best equipment? With this combination and with proper supervision, it should be less difficult in the small shop to meet competition from other manufacturers. We find also that the small shop must buy universal equipment—equipment that does a variety of jobs and can be changed over for different jobs without a great deal of lost time.

Machine Tool Engineers

I wonder if the small shop is really obtaining all the advantages possible from the machine tool industry. The engineers of the machine tool industry are putting forth their efforts at all times to perfect their designs, not only on machines but also on tooling set-ups, for use by industry to produce a product at the lowest cost. This talent without a doubt is available to the small shop if the small shop wants to accept it.

How can the small shop proprietor obtain these advantages? We find usually in such a shop three people vitally interested in the equipment purchasing. These are the engineer, the superintendent, and the purchasing agent. In the very small shop, of course, these three functions are combined in the proprietor.

The engineer is particularly interested in the cost and quality of the product and he wants it to be the best on the market and sold at a price within the reach of all his customers. Therefore, he is particularly interested that the proper equipment be purchased and tooled up in the most efficient way so that low costs can be realized.

The superintendent must be able to do all the things required by the engineering department. He must also be able to meet deliveries, and keep his workmen satisfied by giving them decent equipment to work with.

The Purchasing Agent

The purchasing agent of course wants to make all purchases at the lowest cost. He realizes that the cost of materials that go into a product play a very important part in the selling price. Therefore, he is continually negotiating for better prices on any products which he is purchasing.

Purchasing agents understand that the purchase of machine tools is very different from the purchase of raw materials. However, in many plants, the purchasing agent does not have the time nor the experience to purchase equipment efficiently. In buying a machine, you are also buying the experience and development investment of the company behind it. The machine itself is only a smaller portion of the purchase. All large manufacturers realize this and have prepared a set-up whereby full advantage of the experience and developments behind the machine tool can be secured. This is usually arranged by having a separate organization which gives its entire time to following the developments of the machine tool industry, interviewing sales engineers and collecting all this information for use in the shop.

If such an arrangement is of decided advantage to a large plant, why should it not be equally useful to a small plant? Although there will not be sufficient purchases of machine tools to justify an equipment department some person can be assigned to give part of his time to the collecting of information on machine tools and small tool equipment. It seems to me that this should be the responsibility of either the engineer or the superintendent. Since these men are held directly responsible for the quality, cost and delivery of the product, they should be responsible for the facilities that are provided to do this work.

Either of these departments could select a man who has had mechanical experience on machine tools to act as the equipment man. All requests for new equipment should be submitted to him for investigation and to prepare

the information necessary to present to the management or owners. He would have charge of the budgets and keep an accurate record of expenditures with the cooperation of the accounting department, or bookkeeper. When the management has definitely approved the purchase of the equipment, he would request the purchasing agent to obtain quotations from several manufacturers of this equipment.

Tool Supervisor's Duties

This man would interview all salesmen, keep a file of catalogs and information on machine tools, prepare a comparison between the various propositions submitted for the operation, and submit to the management his recommendation of the equipment which should be purchased. Before submitting his recommendation, he should consult the shop, even to the operator, and assure himself that all are satisfied with the recommendation he is submitting to the management. If the shop does not agree with his selection, he should make it a point to sell his idea before actually purchasing the equipment.

This man should be particularly capable along the lines of drawing out information from the people whom he is interviewing. He can acquire considerable information which undoubtedly will be applicable to many of his operations by his contact with the sales people who call on him from time to time. If a suitable set-up be made, it should not take a great deal of his time and what time he spends on this work will be more than justified by the up-to-date information which he will obtain in manufacturing methods for his shop.

A plan for large users of equipment is mentioned in articles on "How to Buy Machine Tools" (*AM*—Vol. 77, pages 69, 114, and 138).

An important phase of purchasing equipment for any shop is the receiving and installing of a machine. A machine tool costs a lot of money and it can be destroyed in a very few minutes if it is not properly handled when received. Many small shops do not have facilities for unloading machine tools and transporting them to their location. Therefore, it is desirable to issue definite instructions and have them carried out by men who are familiar with this type of work. Information on the handling of machine tools can be obtained from the builder and I am sure he will be only too glad to make the necessary provisions to do this work with the least effort on the part of the customer.

Of equal importance is the method used in starting up the machine after it is installed in its place. Instructions issued by the machine tool manufacturers should be followed very closly and, wherever possible, a representative of the machine tool manufacturer should be present. This does not mean that the small shop operators are not capable of starting them but a machine tool representative can give valuable information as to the things that should be done to give the best results in starting up a machine.

We have been through a serious depression and undoubtedly small shops have suffered severely. However, I believe we can assume, based on things that are happening, that we are on the verge of better business. The small shop plays a very important part in the business life in manufacturing throughout the country. Therefore, it will be necessary for these small shops to equip themselves so that they will be able to meet the competition and at the same time make a legitimate profit after all charges for depreciation, etc., have been deducted. Now is a more opportune time than ever before to get your "house in order" and get ready for better business. The machine tool representative can supply the talent on equipment where the small manufacturer cannot maintain a specialist for this particular activity.

Starting a New Shop on Old Lines

JOHN R. GODFREY

Old Man Johnson was beaming when I dropped in the other day.

"Gee, Godfrey, I wish you'd been with me in Syracuse the other day," he bubbled. "Found an old pal of mine who's starting a new shop in a most unusual way for these days. Largely on reputation and good will as a background for credit. It would do you good Godfrey, to see the atmosphere of that shop. This isn't a fairy tale, old man, though it may sound like it in spots.

"Twenty years in building good machines for textile workers gave him his rep with both his men and his customers. Then the slump hit his personal finances and left him high and dry. And those twenty years are the backbone of his present business.

"When he quit the old firm several of his men told him. 'We want to work for you. If necessary, we'll take half what we are getting and wait for the money to come in to get the rest.' Machinery dealers told him almost the same thing and he rented shop room on a similar basis.

"When the machinery arrived two of the old men came to set it up. 'We ain't working this week anyhow and we'd like to set them up for you. Oh no, we don't want any money, we'd rather do this than loaf.' Others dropped in for a day or two at a time and the plant was ready to go. And they try to tell us that all the milk of human kindness has dried up or gone sour!

"Textile machinery has been notoriously antiquated in design and part replacement is a large item. So new parts were designed to interchange with the old and the mills cottoned to the idea right from the start. Orders came in for the new and improved parts as the new designs pleased the mill managers.

Back Thirty Years

"You must visit his shop, Godfrey, 'twill take you back to the time we both worked for old Farrell. It's like stepping back a few decades—and while it may sound a bit like being a fossil, it did me good to visit this shop.

"The whole air of the shop makes a boss of thirty years ago feel right at home. The owner circulates through the shop, minus coat and vest. The men call him by his first name and everybody knows what everybody else is doing—and why.

"Having had twenty years experience himself as superintendent of the same line of work, the boss has surrounded himself with a force of men he knows. Everyone of them has worked under him before, doing the same work for from six to fifteen years. So it may be just natural that the plant assume the family feeling of long ago. The owner's desk can be seen from the shop floor and workmen have free access.

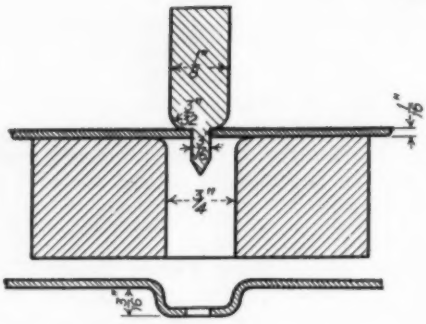
"Out in the shop you stop to talk to Harry, but without looking up he says, 'I've got to get these parts milled before Marvin finishes the shafts, he wants to flat them on this machine. They start assembling after dinner. Shipment promised Thursday.' That's the main part of the production system — general information — plus simple record in the office. You cross the room to Marvin and he says 'I'm trying to get these shafts done by the time Harry is through with the little miller. Got to get some spotted before noon so I can keep ahead of the assemblers this afternoon.'

"With that kind of workmen, low overhead and a plant small enough for careful supervision of product, he believes the prospects are good for keeping running in times like these. And I'm inclined to believe he's right. Our big overhead is a great handicap in times like this."

I wonder if this is along the line of decentralization that Ford and others are thinking about!

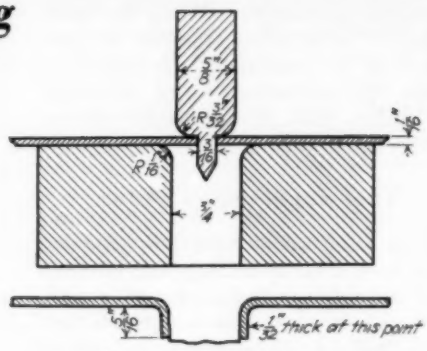
Press Work Pressures

Series XIII—*Forming*

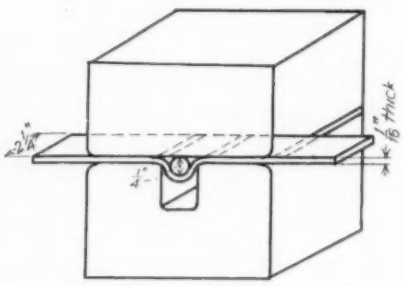


Material--Soft sheet steel, 1/16 in. thick
Operation--Formed well shown
Pressure--4,000 lb.

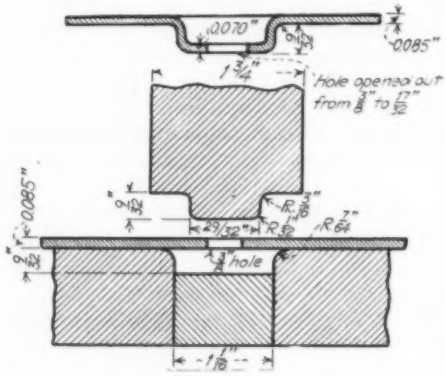
Material--Steel pipe, 1-1/4 in. in diameter
Operation--Opened out the end
Pressure--26,000 lb.



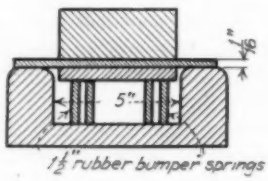
Material--Soft sheet steel, 1/16 in. thick
Operation--Formed well shown
Pressure--3,500 lb. Annealed



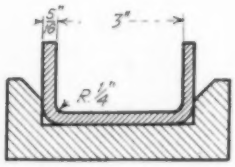
Material--Machine steel, 1/16 in. thick by 2-1/4 in. wide
Operation--Formed as shown
Pressure--6,000 lb.



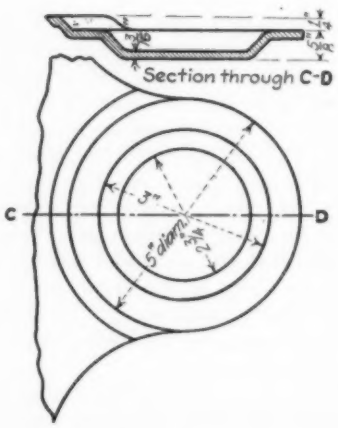
Material--Soft brass strip, 2-7/16 in. long by 2-1/2 in. wide
Operation--A well formed as shown
Pressure--5 tons



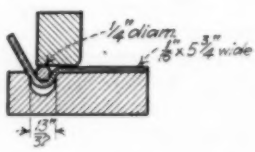
Material--Soft steel, 1/16 in. thick,
A. 1 in. wide B. 2 in. wide
C. 3 in. wide
Operation--Formed, using rubber bumper springs
Pressure--A. 2,000 lb. Bottom flat
B. 2,900 lb. " "
C. 4,000 lb. " "
Springs gave about 1,200 lb. pressure



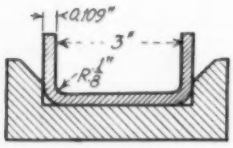
Material--Machine steel, 5/16 in. thick by 3 in. wide
Operation--Formed cold
Pressure--55,000 lb.



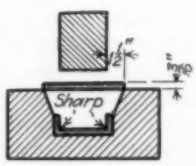
Material--Low carbon machine steel, 3/16 in. thick
Operation--Formed cold
Pressure--102,000 lb.
The work was not quite perfect



Material--A. Soft sheet steel, 1/16 in. thick by 5-3/4 in. wide
B. Soft sheet steel, 5/32 in. thick by 5-3/4 in. wide
Operation--Formed cold
Pressure--A. 4 tons
B. 11 tons



Material--Machine steel, 0.109 in. thick,
A. 1 in. wide B. 2 in. wide
C. 3 in. wide
Operation--Formed as shown
Pressure--A. 4,000 lb. B. 6,000 lb.
C. 10,000 lb.

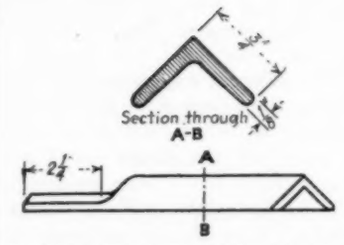


Material--Machine steel, 3/16 in. thick,
A. 1 in. wide B. 2 in. wide
C. 3 in. wide
Operation--Formed with sharp corners
Pressure--A. 12,000 lb. B. 24,000 lb.
C. 36,000 lb.

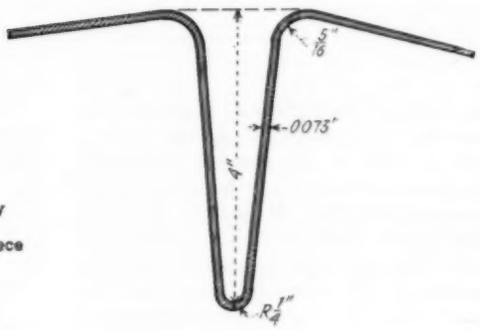
Contributed by C. W. LUCAS *American Machinist*

Press Work Pressures

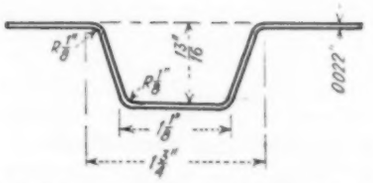
Series XIII—*Forming*



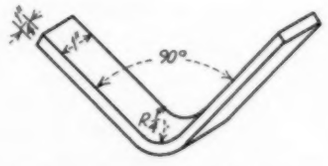
Material--Angle iron, 3/4 by 3/4 in. by 1/8 in. thick
Operation--Flattened 2-1/4 in. of a piece
Pressure--35,000 lb.



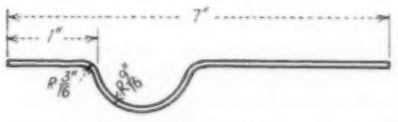
Material--Machine steel, 0.073 in. thick, 6 in. wide and 14 in. long
Operation--Form the one loop
Pressure--8,400 lb.



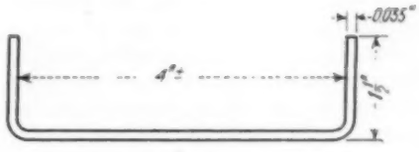
Material--Machine steel, A-0.022 in. thick
B-0.031 in. thick
C-0.0625 in. thick
All pieces 3 in. wide
Operation--Form strip
Pressure--A-2,000 lb.
B-2,500 lb.
C-7,000 lb.



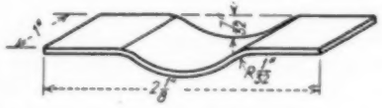
Material--Machine steel, 1/4 in. thick
A-1 in. wide
B-2 in. wide
Operation--Form as shown
Pressure--A-13,000 lb.
B-24,000 lb.



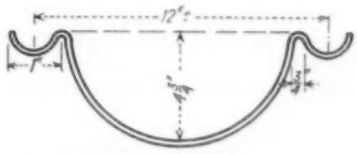
Material--Soft steel, 0.0625 in. thick by 2 in. wide
Operation--Formed as shown
Pressure--5,000 lb.



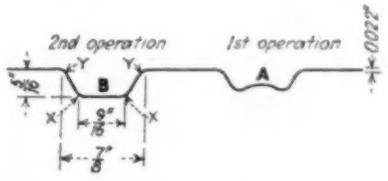
Material--Machine steel strip, 0.035 in. thick by 1 in. wide
Operation--Form as shown
Pressure--200 lb.



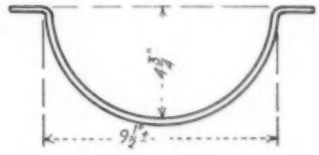
Material--Strip of soft machine steel, 0.047 in. thick by 1 in. wide
Operation--Form as shown
Pressure--1,500 lb.



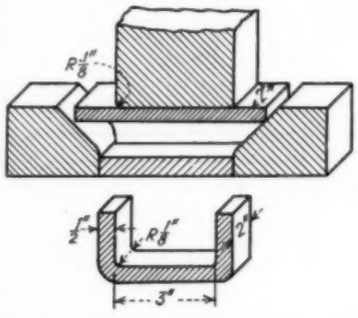
Material--Machine steel, 1/16 in. thick by 1 in. wide
Operation--Form into shape all at once
Pressure--6,000 lb.



Material--Decarbonized steel, 0.022 in. thick by 5 in. wide
Steel made hard by two rollings
Pressure--60,000 lb. required to form and flatten at B. Corrugations at A were made so corners X and Y would form rather sharp when flattened at B



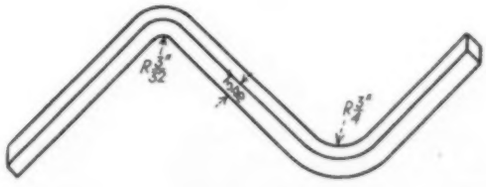
Material--Machine steel, 1/16 in. thick by 1 in. wide
Operation--Form as shown
Pressure--1,000 lb.



Material--Machine steel

Size	Pressure
1/2 in. x 2 in. wide	40 tons - Bottom nearly flat
7/64 x 1	2 " " "
7/64 x 2	3 " " "
7/64 x 3	5 " " "
5/16 x 2	28 " " "
5/16 x 2 (Hot)	3 " " "
A-1/2 x 1/2 Sq.	7,400 lb.- Bottom slightly rounding
B-9/16x 9/16 "	9,500
C-5/8 x 5/8 "	13,300

A-20,700 lb. - Botton flat
B-21,000
C-37,400
Tests made in testing machine



Material--Machine steel, 3/16 in. thick,
A. 1/2 in. wide C. 1-1/2 in. wide
B. 1 in. wide D. 2 in. wide
Operation--Bent as shown. Un-annealed
Pressure--A. 10,400 lb. C. 19,000 lb.
B. 17,400 lb. D. 28,200 lb.

Contributed by C. W. LUCAS © *American Machinist*

• IDEAS FROM PRACTICAL MEN

A Compound Sine Plate

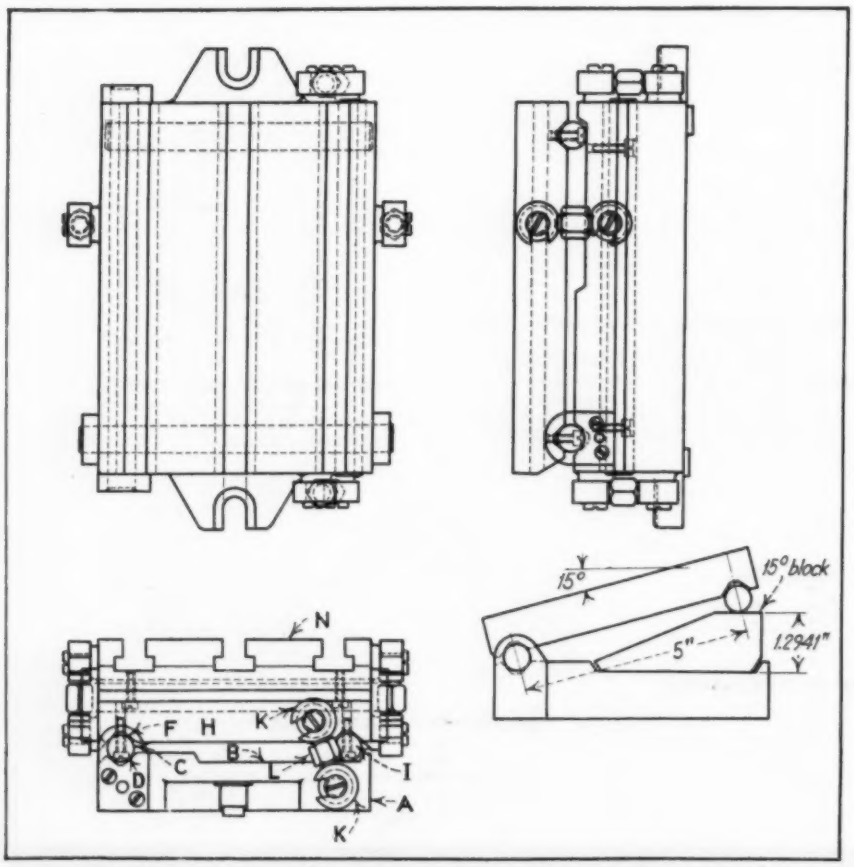
HENRY W. BOEHLY

Herewith is illustrated a compound sine plate that is very accurate and can be made at comparatively little expense. The basic idea was derived from the combination sine plate described by Edward Lay (*AM*—Vol. 76, page 795), the errors of which were pointed out in my discussion of his article (*AM*—Vol. 77, page 90).

The base plate *A* is provided with a slot and with the conventional keys at the ends for locating the device on a machine table. The surface *B* is in line with the underside of pivot pin *C*, which rests in the V-groove *D* and fits in the V-groove *F* in plate *H*, being attached thereto by screws as indicated. The two V-grooves in the under side of plate *H* are identical in depth and angle and are parallel with each other, so that pins *C* and *I* will be in parallel alignment. Studs are attached to the sides of the base and to plate *H* and to them are fitted hook bolts *K*. The hook bolts have threaded shanks, one of each pair having right- while the other has left-hand threads. They can be drawn together by the turnbuckle nut *L*, thus the plates can be locked together at any angle to which they are set. A few sets of hook bolts of varying lengths are necessary on account of the wide variation in the distance between the studs when the plates are set at different angles.

The top plate *N* is provided with T-slots for clamp bolts and is pivotally attached to plate *H* in the same way as that plate is attached to the base, and is locked by similar means, but, of course, its pivot is at 90 deg. to that of plate *H*. By inspecting the view at the lower right it will be seen that to set either of the plates to an angle of 15 deg., a block 1.2941 in. high will be required. Since the center distance between the pins *C* and *I* is 5 in., the height of the block is just one-half that of a block for a 10-in. sine bar. The heights of blocks for different angles can be found by dividing the values given in the standard sine-bar tables by two.

Not only will the device serve as a grinding fixture, but it can be used as a fixture for laying out, drilling and milling where either simple or compound angles are required.

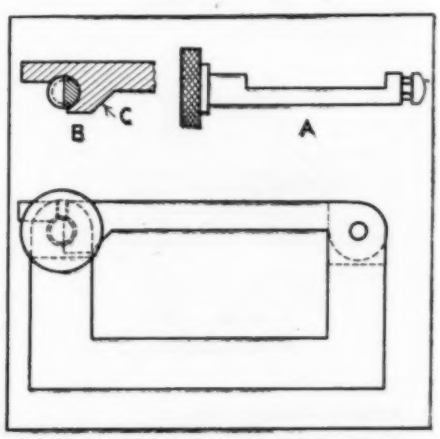


Work mounted on this compound sine plate can be accurately machined to either simple or compound angles

Locking Pin for a Jig Leaf

JOHN G. JERGENS

A pin for locking the leaf of a jig is shown at *A* in the illustration. It is quick in action and holds the leaf securely. The pin goes through the rear wall of the jig, engages a locking lug in the leaf, and is retained in position by a screw engaging a groove at one end. The groove is cut but part way around the pin, the blank part forming a stop to prevent the pin from being rotated more than half a revolution. At the opposite end of the pin is a knurled knob by which it can be rotated. In the middle, the pin is cut away for half its diameter for a distance equal to the width of the leaf. The leaf and the rear wall



The jig leaf is locked and unlocked by a half revolution of the pin

of the jig are drilled and reamed for the pin while the leaf is in place. The rear end of the leaf is then machined as at *B* in the sectional view to form the locking lug *C*. This view shows the leaf in the locked position.

It will readily be seen that when the pin is rotated so that the flat part is toward the locking lug, the leaf is unlocked and can be raised for loading or

unloading the work. Also, that when the pin is rotated so that its flat part is away from the locking lug, its round part engages the lug and holds the leaf securely. The rear end of the locking lug is cut away for ¼ in. beyond the center of the hole to give ample clearance for it to pass the flat on the pin as the leaf is raised or lowered.

Tools That Were a Failure
Discussion

E. DUCHESNE
General Small-Tool Supervisor, American Locomotive Company

Referring to the article by Forrest L. Johnson under the title given above (*AM*—Vol. 77, page 284), why not do the bending on the side of the disk or faceplate? Holes of the diameter of the stock could be drilled to a depth equal to the length of the threaded shanks of the hooks, the bottoms of the holes acting as stops. From the bottoms of the holes, holes ⅛ in. in diameter could be continued through the disk, serving for the entrance of compressed air to eject the finished hooks.

Drilling and Reaming Holes at Accurate Center Distances

GEORGE J. MURDOCK
Murdock Research Laboratory

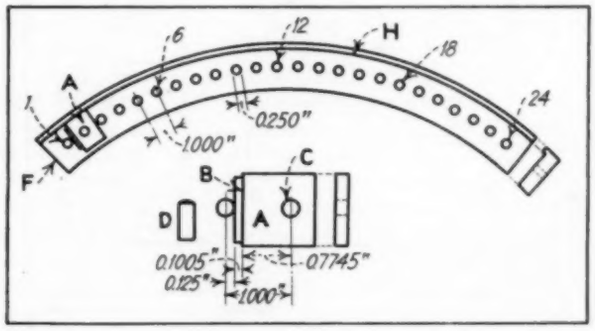
The problem presented was to drill and ream 24 holes accurately in each of several tool-steel segments, one of which may be seen in the illustration. The holes were to be 0.250 in. in diameter with center distances of 1 in., the tolerance for center distance being 0.0002 in., plus or minus. No tolerance was allowed in the distance between the first and last holes, as measured on the chord of the arc.

A simple jig *A* having a single hole was made and hardened, the whole being ground and lapped to the required size. The end *B* of the jig was accurately ground and lapped to 0.7745 in. from the center of the hole *C*, special care being taken to have this end of the jig square with both its bottom and the hole. Two pins *D* were made a close gage fit in the hole. The distance between the center of the hole and the end *B*, together with half the diameter of one of the pins and a 0.1005-in. gage block made up the distance of 1 in. the holes were to be apart.

Both the jig and the gage block were placed on a segment so that the edge of the gage block was flush with the end *F* of the segment and the top of the jig was in contact with the rib *H*. After carefully clamping the jig and removing the gage block, the work was placed in a drill press in which every precaution had been taken to prevent inaccuracies of the machine from introducing improper conditions. The hole was spotted through the jig, and with this spotting as a center, the hole was drilled with a D-size drill having the lips correctly ground as to length and angle and rounded at the junction of the flutes to produce a reaming effect. The resulting hole was then reamed through the jig with a special reamer. The drills and the reamer had taper shanks to insure true running.

One of the pins *D* was tapped lightly into the reamed hole, after which the hole was checked and was found to be 0.0002 in. too close to the end of the segment, but the correct distance from the rib. To correct this error and prevent its appearance in the next hole was not necessary, as the error was within the tolerance allowed, and besides, the distance from the center of this hole to the end of the segment was not of great importance. The jig was then moved for hole No. 2, using the same gage block against the pin, which still remained in Hole No. 1. After drilling and reaming hole No. 2, its center distances from hole No. 1 and from the rib *H* were checked and found to be correct. With the pin in hole No. 2, the jig was moved for hole No. 3, the gage block being between the jig and the pin. After this hole was finished, it was checked and was found to be 0.0001 in. too close to hole No. 2. To correct this error, at the next move of the jig a 0.1006-in. gage block was used between the end of the jig and the pin, with the result that hole No. 4 was found to be correct. In this manner the entire series of holes in the segment were finished. Nearly all the holes checked correctly from the preceding holes, but in no hole was found an error of more than 0.0001 in. When an error was found it was corrected in the next hole by using a gage block differing by the same amount from the one previously used.

It will be understood that the care taken in all details up to the actual drilling and reaming was responsible for the accurate results obtained. Not only were accurate results obtained, but the cost of the work was considerably less than the estimate.



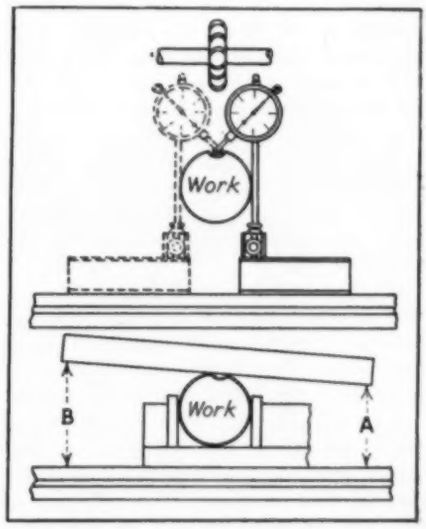
By this method of indexing, greater accuracy is possible than by the usual step-by-step method

Setting the Index Centers Central With a Formed Cutter
Discussion

CARL SCHULTZ

In reading the article by J. Arthur Spohr under the title given above (*AM*—Vol. 77, page 346), it recalled some methods I have used for centralizing cutters, and which I think have certain advantages over the method described by Mr. Spohr.

Ordinarily, if the cutter has parallel sides, I check its position by means of a dial indicator, first on one side and then on the other. With the work between the centers, the standard of the indicator is adjusted so that it is in contact with the work when the indicator point is in contact with one side of the cutter. A reading is taken and the indicator is applied to the opposite side of the cutter. The difference in the readings tells how much and in what direction to move the cross-slide to bring the work central with the cutter.



The work can be centralized with the cutter by the methods illustrated

Past experience, however, has proved that the center of the form on the cutter is not always midway between the sides. Therefore, the more accurate method is to take a trial cut and to bring the indicator alternately into contact with the opposite sides of the cut itself, as shown in the upper view in the illustration.

If for any reason this method can not be used, such as when the work is held in the vise, and the vise is in the way of the indicator base, a straight-edge placed across the work in contact with both sides of the cut will show the error, as may be seen in the lower view. For some classes of work the eye will be sufficient guide for judging how near the straight-edge is parallel with the table of the machine. For greater accuracy, the distances *A* and *B* should be measured with inside calipers; or the difference can be found by an indicator.

Shearing-In Small Punches in Hardened Dies

E. E. KEELER

A die-set without the shank for the punch-holder and with leader pins twice the usual length will be found very useful for shearing-in small punches in hardened dies. In use, the die is placed in the center of the base, and the punch (previously chamfered enough to slightly enter the die) is put in place. The movable member of the die set is then grasped by the hands on each side and raised and is pushed down on the punch with a quick stroke, forcing it into the die far enough to make marks indicating how much and where metal is to be removed. After removing the metal as indicated by the marks, this process is repeated after each filing or machining until the punch enters the die the required distance.

A great advantage of using this device is that it can be set on the work bench, close to hand, and will save the time of running to the arbor press each time the punch is to be forced farther into the die. Also, it eliminates all danger from poor alignment, as the leader pins keep the movable member parallel with the base. When the punch has been relieved enough for the final shear-in, a few rapid blows with the movable member will send it home. In backing the punch out of the die, it is necessary only to turn both parts upside down, block up the die so that the punch shank will be above the base, and insert a parallel piece in the die large enough to cover as much of the area of the punch as is possible. A light blow with the movable member will drive the punch out of the die without injury to either the punch or the die.

Standardizing Die Construction

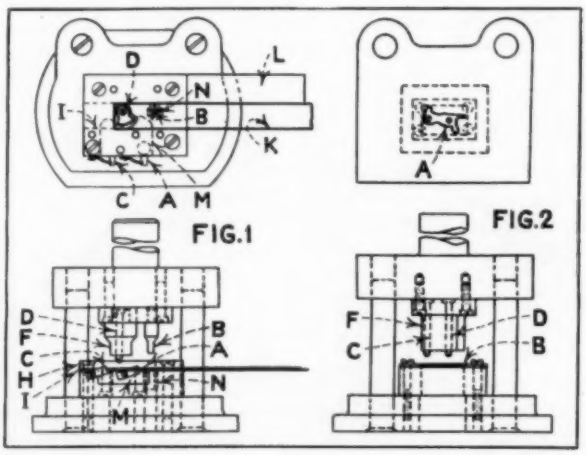
F. SERVER

In designing press tools for the general run of competitive work, it is essential to standardize on simple construction. There is a decided advantage in using similar holders for different punches and dies, so that after one job has been completed the same holders can be used for tools on other jobs. A complete knowledge of the available press equipment in which the tools are to be used will often enable the designer to save money by omitting the non-essentials.

In the pillar-press tools in Fig. 1, no automatic stop has been provided for locating the stock, because the press in which the tools are to be used is equipped with an automatic roll-feed in which the rolls open slightly after each feeding, halting the stock while it is located by a pilot in the punch-holder. A general view of the tools is given in the elevation, while the plan view is of the die only.

The stock is fed by hand from right to left against the finger stop *A*, which is normally held clear of the stock by a spring, but is pushed in by the finger for a temporary location. As the ram descends, a hole is pierced in the stock by the punch *B*. As the ram ascends, the stock is advanced against the finger stop *C* which is operated in the same manner as the stop *A*. As the ram descends, the pilot *D* enters the hole just pierced and holds the stock in position while the punch *F* blanks the piece. Thereafter the feed is automatic and a piece is produced at each stroke of the press. On the die are mounted the stripper *H* and the stock guides *I*, *K*, and *L*. An insert *M*, forming the die for cutting the teeth in the gear segment is provided, so that it may be readily replaced if broken without making a whole new die. At *N* is a replaceable bushing forming the piercing die.

In Fig. 2 is a plain nesting die for blanking the irregular part *A*. The plan at the top shows the punch as seen looking down on the punch-holder from above. The principal object in showing these tools is to point out the importance of general standardization. It will be seen that the pillar press in which the tools are mounted is the same as that in Fig. 1, although the operation of the tools is entirely different. The die has a nesting plate *B* in which is placed a rectangular piece of stock having two holes pierced in a previous operation. As the ram descends, pilots *C* and *D* enter these holes and hold the stock while punch *F* blanks the part. This construction was adopted because of the limited quantity of parts to be made.



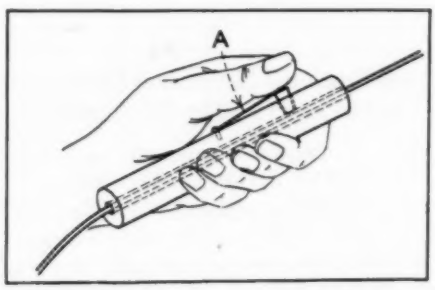
Although the operations of the tools are entirely different, both sets are used in the same pillar press

A Safety Wire-Holder

JOSEPH M. O'DIOBINCK

In winding springs around a mandrel in the lathe, splinters or burrs on the surface of the wire may cause injury to the hand holding the wire.

If a holder such as is shown in the illustration is used, the hand will be protected. The holder is simply a piece of round metal having a ¼-in. hole drilled through it lengthwise and fitted with a thumb brake, as at *A*. By means of this brake, any desired tension can be put upon the wire.



The moving wire cannot injure the hand

SHOP EQUIPMENT NEWS

While a single-spindle, spiral-bevel-gear hobbing machine is shown, the same hob and work-head units can be used on a rotary type machine when multiple spindles are required. Cutter shown has removable cutting teeth

Cleveland Hobbing Machine for Spiral Bevel Gears

A method and machine for the continuous cutting of spiral bevel gears has been developed by the Cleveland Hobbing Machine Company, Cleveland, Ohio. Both cutter and gear blank are rotated in continuous cutting engagement with each other, a stepped cam being used to feed the work after each revolution of the blank. A hob speed of 40 r.p.m. is maintained for cutting a conventional 37-tooth spiral bevel gear, three to five revolutions of the gear blank being made, depending on the kind of material. The hob makes 37 revolutions for each step in the cam. After the blank is fed by means of the cam to the proper depth, the work remains in that position until the hob passes through the 37 teeth. Then the next step repeats the operation.

The hob is an angular disk from one face of which extend the cutting teeth in a direction parallel to the axis of the cutter. The cutting teeth are arranged on a spiral, the lead of which equals the circular pitch of the gear to be cut.

Cutter teeth are of different widths or thicknesses, several of the first teeth having a cutting action similar to a broach. The teeth following the stepped teeth generate the proper form of each tooth in the gear blank.

Specifications of the single-spindle machine follow: anti-friction bearings; gears driven with splined shaft; all bevel gears are spiral and hardened; width of machine—52 in.; depth of machine—60 in.; height over motor—84 in.; capacity—12 in. O.D.; capacity—8 D.P. to 3 D.P.; weight, 7,000 lb.

Rogers Type M Automatic Knife Grinder

A Type M automatic knife grinder with electric time clock control and a reversible motor and grinding wheel has been placed on the market by Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y. This machine is made in four sizes: 38, 55, 76 and 90 in. (or longer). It will sharpen the average knife in from 15 to 20 min. It will grind light shear blades, and flat face or concave bevels.

By means of a special electric timing device or clock, the grinding operation, including cross feeding and table traverse, is automatically controlled. The timer can be set to cut off the power and stop grinding automatically at the end of any period from 1 to 45 min. At the end of each table traverse or stroke the rotation of the grinding wheel changes.

The knife table is of heavy, slotted

pattern with large bearings and mountings for rigid support. It is provided with clamps and bolts for holding knives in position and fitted with knife gages to facilitate quick set-up. An 8-in. in diameter by 3½-in. special cup grinding wheel is fitted on the ball-bearing motor shaft. Standard equipment includes a centrifugal pump with valve to regulate the coolant flow.

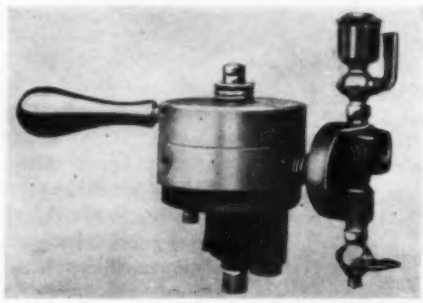
"Wheelabrator" Abrasive Cleaning Device

A mechanical abrasive cleaning device, which does not require compressed air, has been placed on the market by the American Foundry Equipment Co., Mishawaka, Ind. Abrasive suited to the work is fed by gravity from a storage hopper into the "Wheelabrator," Fig. 1. From this specially designed and constructed wheel, abrasive is ejected and cleans the work which passes beneath. Velocity of the abrasive is less than that of sand blasting with 90-lb. pressure, but a larger quantity is ejected. Since the velocity is less the abrasive does not disintegrate so quickly and pass off as dust. Practically the only wearing parts are the throwing blades and wheel guard. The replacement cost of these is said to compare favorably with nozzle expense in pressure blasting. It is claimed that one Wheelabrator is equal in production and quality of cleaning to six abrasive blast nozzles, ¼ in. size, at 90 lb. air pressure. Power requirements do not exceed 10 hp.

Various types of cleaning machines have been developed for use with the Wheelabrator. The "Tum Blast" Fig. 2, employs one Wheelbrator unit powered by a 10-hp. motor. The Wheelbrator can also be applied to blast cleaning cabinets, rooms or rotary tables in which the work to be cleaned can be moved under the stationary unit. The automatic rotary table is another type of equipment on which the Wheelabrator can be applied.

Minard Economy Air Valve and Filter

For air-operated equipment the Detroit Tool & Forge Co., 656 Smith Ave., Detroit, Mich., is now making the Minard economy air valve and oil filter. This device was formerly made by the National Sales Engineering Corp., Detroit. The valve can be used in connection with any double-acting air cylinder where the minimum amount of air consumed is a feature in the performance of equipment and fixtures. The valve was developed for the return of the compressed air from the exhaust side to the live side of the cylinder, and to allow only enough live air to pass through the auxiliary valve to operate the attached equipment. The filter is designed to prevent scale and dirt in the air line from being carried into the valve or revolving connection. Both the air cylinder and valve can be cleaned by opening the drain cock. The valve can be mounted in either a horizontal, vertical or angular position.



Milford Resistor Hack Saw Blades

The Henry G. Thompson & Son Co., New Haven, Conn., has brought out a line of Milford resistor hack saw blades made in hand frame and power machine sizes. The hack saw blades have been tested on cutting of nickel, high speed steel, manganese steel, welded pipe and angle iron. The following data illustrates the speed and endurance of these blades. The saws tested were 14x1x 0.065 in.—10 T. per in. The material cut was 4 in. square chrome nickel test

Fig. 2—"Wheelabrator" applied to an "American" Tum Blast Cleaner. The Wheelabrator requires no compressed air

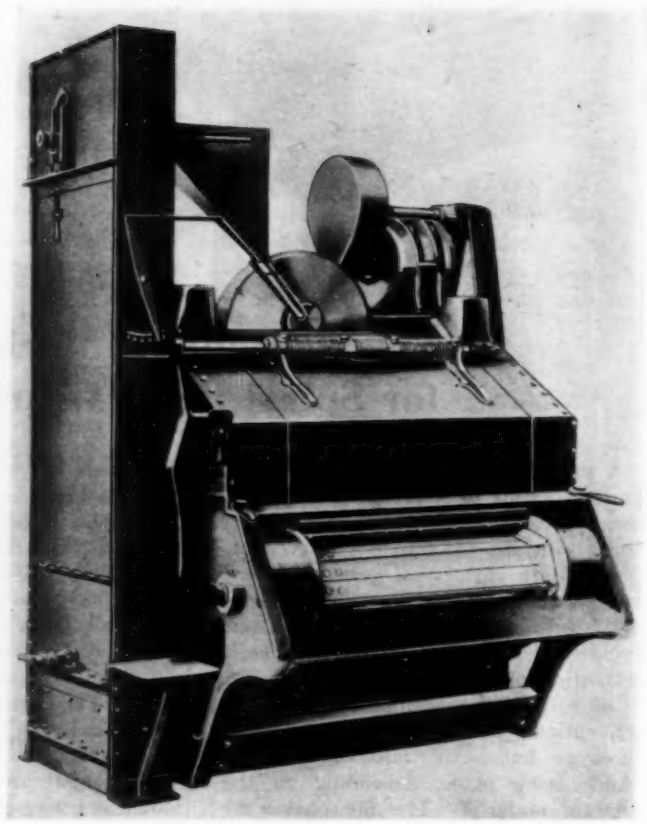
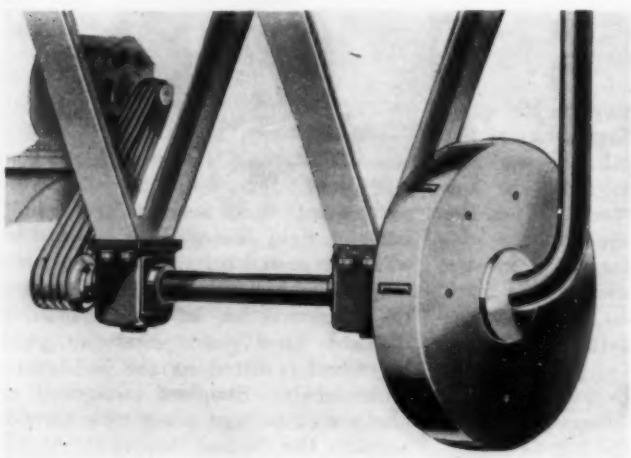


Fig. 1 — Wheelabrator Abrasive Cleaning Device which takes abrasive from a storage hopper and by means of throwing blades ejects the abrasive at high velocity upon the work



bar, SAE 3140. Speed of operation was 145 strokes per minute, with coolant. Time per cut of the first test bar was 10.5 min. and the number of cuts per test bar was 24.4, per blade.

Oxweld Aluminum Flux

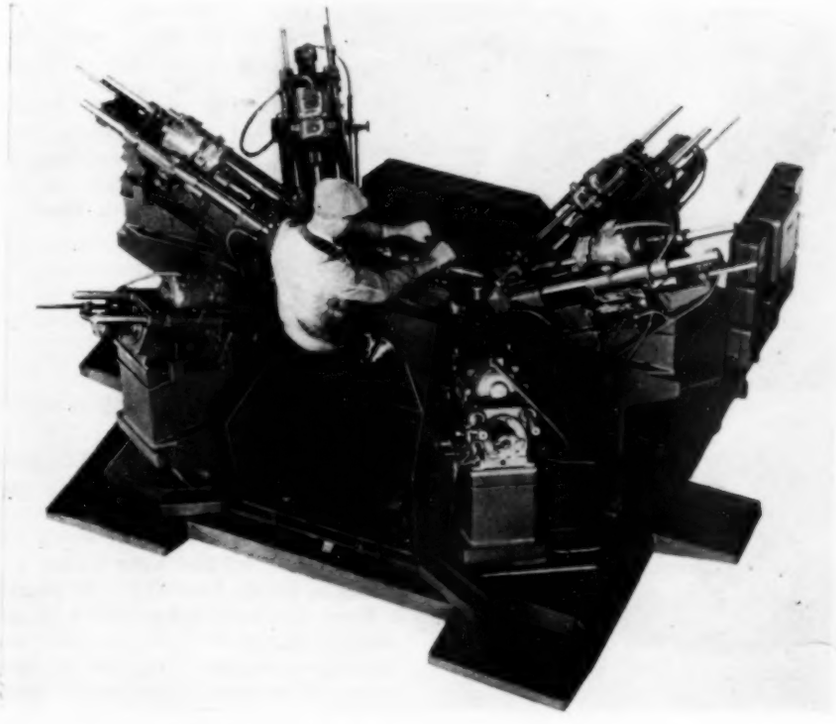
An all-purpose aluminum welding flux has been announced by The Linde Air Products Co., 30 E. 42nd St., New York, N. Y. This flux is intended to replace the two fluxes previously marketed, one for welding pure aluminum and the other for welding aluminum alloys. The flux is packed in ¼-lb. jars.

Natco Special Six-Way Crankshaft Oil-Hole Drilling Machine

The National Automatic Tool Co., Richmond, Ind., recently furnished to an automobile manufacturer a six-headed special hydraulic feed drilling machine arranged to drill the oil holes in a forged steel crankshaft. The machine is semi-automatic in operation and all heads are controlled by a single treadle.

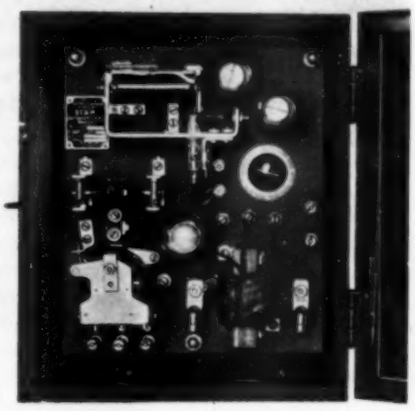
Each drilling unit is equipped with a single spindle arranged with nose adjustment. A special valve and trip mechanism permits automatic variation of drilling depths, making possible the step drilling of the deep holes in the crankshaft. This feature permits the relieving of chips and the cooling of the drills during the drilling operation. In addition, a cleaner hole is obtained.

The fixture furnished is of the four-position trunnion type and is arranged to hold one crankshaft in each position. The base is of welded construction and forms a reservoir for the hydraulic and coolant systems. Production of approximately 25 crankshafts per hour is obtained from this machine. Its weight is approximately 17,000 lb.



"E. C. & M." Automatic Weld Timer

For use in connection with resistance welding machines, The Electric Controller & Mfg. Co., 2690 E. 79th St., Cleveland, Ohio, has developed an automatic weld timer. This device does not provide a definite amount of time for each weld, but varies the time automatically in inverse proportion to the rate of current flow in order to produce a satisfactory weld at each operation. The original adjustment of the timer is easily made by welding a few scrap pieces of the work to be done and then tearing the welds apart for inspection. When the desired weld is obtained, the cabinet door may be locked.



The standard type of automatic weld timer is illustrated. It consists of a rectifier tube which charges a fixed condenser in proportion to the rate of current flowing in the welding circuit. When the charge reaches an amount sufficient to pass current through two neon-gas-filled tubes, a small relay is operated which in turn opens the relay controlling the main line contactor. The tubes are in the circuit only when the welding current is on so that as soon as the main welding circuit is opened, the weld timer is ready for the next operation. Other forms of weld timers are supplied where required. One is the automatic repeat type which has an additional timing element to govern the length of time the electrodes are apart. Another style prevents the operator from separating the electrodes from the work before the welding current has been interrupted.

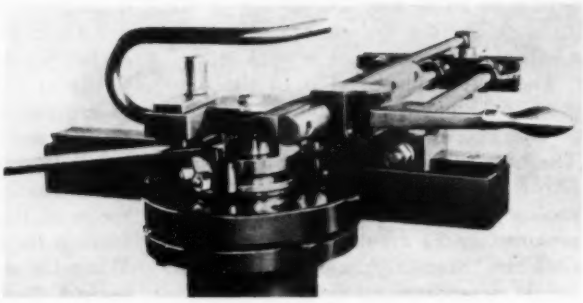
Brown & Sharpe No. 315 Steel Rule and Pocket Case

The Brown & Sharpe Manufacturing Co., Providence, R. I., has brought out the No. 315 tempered steel rule graduated in 10ths and 50ths to facilitate measurements where dimensions are in decimals, eliminating the necessity of converting the decimals into fractions. The opposite side of the rule is graduated in 32nds and 64ths.

A pocket saving rule case has also been placed on the market. This rule case is made of dull-finish aluminum and has well rounded corners. One side has a slot at the bottom for pushing the rule out while the other side carries a decimal equivalent table. The pocket case is suitable for 6 in. rules up to 0.045 in. thick and up to ¾ in. wide. The rule case is known as No. 360.

Climax Tube-Bending Machine

The Climax tube-bending machine is now being offered by the Schatz Mfg. Co., Poughkeepsie, N. Y., in hand- or motor-driven types for bending steel and non-ferrous tubes, the largest capacity



Climax Size R.11 Hand-Type Tube Bending Machine which has capacity for bending up to 1 3/16 in. O.D. steel and 1 9/16 in. O.D. non-ferrous tubes

being for steel tubes up to 8 in. O.D. and non-ferrous tubes up to 10 in. O.D. The R.11 size illustrated is hand-operated, and has capacity for bending up to 1⅞ in O.D. in steel and up to 1⅞ in. O.D. in non-ferrous tubes.

The machine makes bends cold, without filling, and has a patented mandrel and machine release. When the material lends itself, the machine can bend down to a radius of 1½ times the outside diameter of the tube, measured to the center of the tube. Performance is approximately 60 to 80 bends per hr. All segments are arranged for bending up to 180 deg. A finely graduated gage assists in accurate bending. Right or left-hand bends can be made. Special segments can be furnished for making bends that run into one another, such as seen in bicycle handle-bars, for example.

The two largest motor-driven models have two working speeds and accelerated return of the segment to the original bending position. Machines are built sufficiently strong to bend S.A.E. 4130 steel tubes and annealed Allegheny Metal tubes.

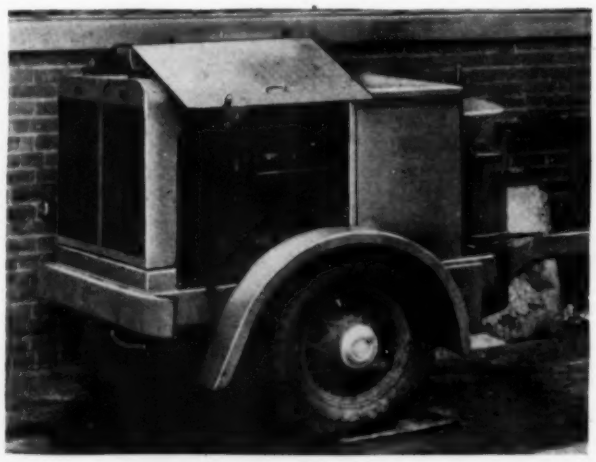
Federal Model 644 Thickness Gage

The Federal Products Corp., 1144 Eddy St., Providence, R. I., has developed a Model 644 thickness gage which has a feature of solidly clamping the material before the measuring anvils come in contact with the work. This feature eliminates the questionable effect of human touch and of determining when the material is in alignment with the gaging points, which is necessary to obtain a positive and accurate measurement.

The gage is constructed with two aligning surfaces ¾ in. in diameter. In the center of the lower surface is a stationary gaging point and in the upper surface is a gaging point making direct contact with the dial indicator. After the work is inserted between the anvils, the lever on the handle is released, and the material is clamped in alignment with the two indicating points. The proper thickness of the material is shown immediately on the dial indicator. The projecting triangular shoe under the lower anvil is merely to facilitate locating the material between the anvils. Two tolerance hands are provided on the dial indicator.

Chrysler Portable Air Compressor

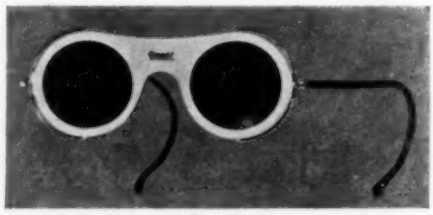
Chrysler Motors, Amplex Division, 7900 Jos. Campau Ave., Detroit, Mich., has developed a portable air compressor consisting of a special four-cylinder air compressor, a V-belt-driven four-cylinder industrial engine with two radiators, air tank and accessories mounted on a rigid frame and carried on two pneumatic tired wheels with springs. The feature is the governing control which allows the compressor to operate at speeds in proportion to the demand for air, thus producing high efficiency at all speeds. Compressor intake and exhaust valves are mechanically operated. The compressor is equipped with an intake silencer on the compressor and a muffler on the engine for quietness. Electric starting is standard equipment.



One of several Chrysler Portable Air Compressors operating 24 hours a day at the Plymouth Plant

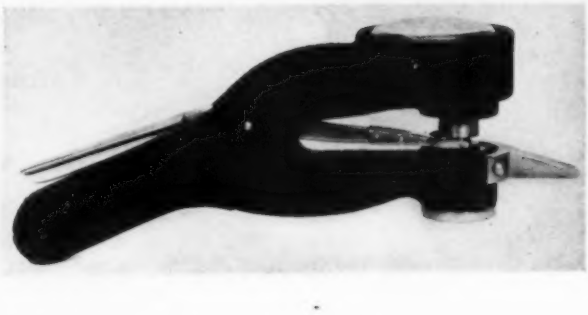
Oxweld No. 15 Welding Spectacles

The Linde Air Products Co., 30 E. 42nd St., New York, N. Y., has announced a No. 15 welding spectacle and a lens, Type AA. In the spectacle, the lenses are mounted in a natural canvas-bakelite frame and are 50 mm. in diameter. This large width permits a wider angle of vision and permits greater protection against light and sparks. The temples are covered with insulating



material, and the frame is non-flammable and does not conduct heat. It is possible to change lenses in a few seconds. Oxweld Type AA, A or B lenses can be furnished in the same colors and shades as for the Oxweld No. 12 goggles.

Type AA lens, flat-ground and polished, is made in light, medium and dark green shades. The use of these lenses is recommended where safety

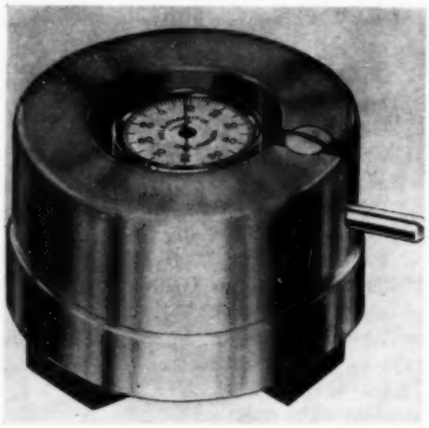


Work is clamped between aligning surfaces before gaging points of the Federal Model 644 Thickness Gage make contact with the work

codes prevent the use of other lenses which are not flat-ground and polished, although equally effective otherwise.

Starrett Vibrometer

The L. S. Starrett Co., Athol, Mass., has developed an instrument known as the "Vibrometer" for measuring amplitude of vibration in machinery. The instrument is useful for checking the



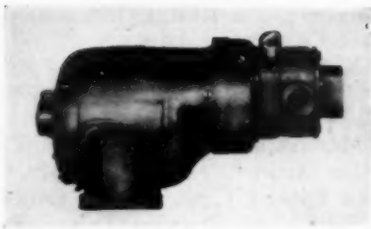
balance of units revolving at high speeds. It is designed for ease and convenience of use. All parts are chromium and nickel-plated. A carrying case is provided.

Trent Electrically Heated Oil Tempering Bath

The Harold E. Trent Co., 618-640 N. 54th St., Philadelphia, Pa., has developed an electrically heated oil tempering bath with an oil-circulating system incorporating a pump. If the oil rises to too high a temperature, it is bypassed through a water-cooling column until the temperature is brought down to the required value. In addition, a temperature control gage, which can be set to the required value, and which functions through a control panel, is supplied. By this means, the correct temperature of the oil is obtainable.

Brown & Sharpe Nos. 101, 102 and 103 Geared Motorpumps

The Brown & Sharpe Mfg. Co., Providence, R. I., is offering both horizontal and vertical types of geared "Motorpumps" that have advantages where a power takeoff is either not handily located or not possible. The individual motor drive permits a mounting most



convenient to the tank. Spiral gears are used in both the pump and reduction drive from the motor to afford quietness. Optional gear ratios, to give pump speeds of either 600 or 900 r.p.m. can be furnished where the individual requirements vary as to capacity. The pump will run in either direction. Capacities: No. 101 pump, 3 to 4½ gal. per min.; No. 102, 6 to 9 gal. per min.; No. 103, 12 to 18 gal. per min.

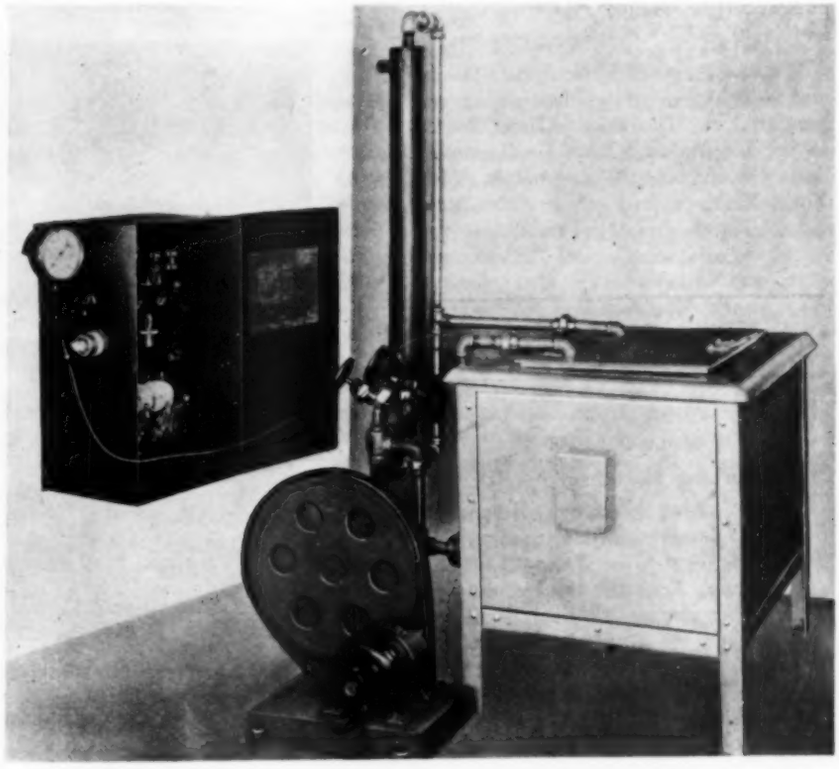
• TRADE • PUBLICATIONS

INDEX OF ECONOMIC REPORTS. The Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y., has published "Index of Economic Reports," which lists the titles of over 500 reports and articles on problems of business management that have been published and made available for distribution by the Bureau.

MOLYBDENUM. The Climax Molybdenum Co., 295 Madison Ave., New York, has published a booklet "Mo-lyb-den-um 1933" listing the properties imparted to steel by the addition of molybdenum, commercial steels of this type, steel castings.

MOTORS. Part 5A of Bulletin 167 has been published by the Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo., on long-hour duty, split-phase motors. Illustrations of motor parts are surrounded by paragraphs describing every part, its function and construction.

MOTORS. The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is distributing Leaflet L 20580 on the Type FH resistance split-phase motors suitable for grinders, small wood-working tools and other industrial machines and domestic applications.



MOTOR DRIVES. Leaflet L 20584, issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes a complete line of splash- and drip-proof motors and control.

OLDER EMPLOYEES. A survey entitled "The Older Employee in Industry," prepared by the Metropolitan Life Insurance Co., Policyholders Service Bureau, 1 Madison Ave., New York, N. Y., tabulates, analyzes, and prepares for presentation details of plans in force in manufacturing establishments for handling the employees who have grown old in service and whose ability has become lessened.

STEEL STOCK LIST. Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Post Office Box U, Chicago, Ill., has published a larger and more complete "Stock List," running over 200 pages and including complete information and data on practically every kind of steel made, including special grades of cold-finished steels, alloy steel, stainless steels, besides non-ferrous metals.

SWITCHES. General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-1761 on Type CR1061 motor-starting switches for fractional-horsepower motors.

TECHNICAL EDUCATION. A "Survey of Adult Technical Education in the New York Industrial Area" has been published by the Chamber of Commerce of the State of New York, 65 Liberty St., New York, N. Y. The survey describes the various engineering and technical institutes in the metropolitan area, presents their facilities and capacities, and gives a list of evening courses.

WELDED PIPING. Typical installations and advantages of welded piping are presented in "The Facts About Welded Piping for Buildings" by Air Reduction Sales Co., Lincoln Bldg., 42nd St., New York, N. Y.

• PATENTS •

JULY 18, 1933

Metal-Working Machinery

Metal-Cutting Machine. Bernard P. Schlitz, Cleveland, Ohio, assigned to The Foote-Burt Co. Patent 1,918,290.

Combined Eccentric and Concentric Turning Apparatus. William F. Groene and Arthur W. Aufderhar, Cincinnati, Ohio, assigned to The R. K. Le Blond Machine Tool Co. Patent 1,918,331.

Feed-Change Mechanism for Lathes. William F. Groene, Cincinnati, Ohio, assigned to The R. K. Le Blond Machine Tool Co. Patent 1,918,332.

Nut Running Apparatus. Fred Brown Pfeiffer, Akron, Ohio, assigned to Cupples Co. Patent 1,918,557.

Machine for Manufacturing Taps and Other Articles. Abram D. Wilt, Jr., New Canaan, Conn. Patent 1,918,626.

Sheet-Metal Drawing Press. Fredrich J. Rode, Chicago, Ill. Patent 1,918,784.

Grinding Machine (Cutter). Carl J. Anderson, Chicago, Ill., assigned to Carl U. Johanson and Erik Borg. Patent 1,918,951.

Electrical Feed for Planers. John C. Shaw and Robert D. Shaw, Brooklyn, N. Y., assigned to Pratt & Whitney Co. Patent 1,918,990.

Grinding Machine. George W. Binns, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,919,143.

Grinding Machine. Clement Booth, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,919,144.

Milling Machine. Lester F. Nenninger, Cincinnati, Ohio, assigned to The Cincinnati Milling Machine Co. Patent 1,919,150.

Burnishing Machine. Richard A. Wilkins, Beverly, Mass., assigned to Industrial Development Corp. Patent 1,919,152.

Flexible Shaft Bench Grinder. Alwin B. Bachmann, Brooklyn, and William Krause, Bronx, N. Y., assigned to Pratt & Whitney Co. Patent 1,918,952.

Tools and Attachments

Chuck. Lawrence K. Warman, Erie, Pa., assigned to Williams Tool Corp. Patent 1,918,439.

Chuck. Fred J. Bechert, Stamford, Conn., assigned to the Fafnir Bearing Co. Patent 1,918,955.

Lathe Center and Bearing Means Therefor. George R. Bott, Stamford, Conn., assigned to Norma-Hoffman Bearings Corp. Patent 1,919,004.

JULY 25, 1933

Metal-Working Machinery

Milling Machine. John M. Christman, Detroit, Mich., assigned to Packard Motor Car Co. Patent 1,919,290.

Grinding Machine. Clement Booth, Cincinnati, Ohio, assigned to The Heald Machine Co. Patent 1,919,615.

Lathe. Herman W. Melling, Jackson, Mich. Patent 1,919,738.

Press. Arthur A. Byerlein, Detroit, Mich., assigned to General Machinery Corp. Patent 1,919,771.

Feed Mechanism for Grinding Machines. Arthur A. Kottman, Davenport, Iowa, assigned to The Micro Corp. Patent 1,919,790.

Grinding Machine and the Like. George Gorton, Racine, Wis. Patent 1,920,073.

Processes

Method and Apparatus for Truing a Grinding Wheel. Stanley W. Bath, Shrewsbury, Mass., assigned to John Bath & Co. Patent 1,919,288.

Timken exhibits the largest anti-friction bearing ever made at A Century of Progress. The bearing weighs 3½ tons and has a capacity of 8,000,000 lb. It is designed for the roll necks of steel mills. A bearing for railroad use is also shown